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SYMPOSIUM ON THE HISTORY OF AMERICAN MEDICINE

PART III

A Brief Sketch of the Rise of American Medical Societies — W. B. McDANIEL, II

The Nineteenth Century American Physician as a Research Scientist — PHYLLIS ALLEN RICHMOND

Trends in American Public Health, from the Colonial Period to the Present — GEORGE ROSEN

American Medicine in the World Today: An Historical Perspective and Reappraisal — RALPH H. MAJOR

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Professor and Director of the Department of the History of Medicine,
New York Medical College, Flower and Fifth Avenue Hospitals, New York, N. Y.

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SYMPOSIUM ON THE HISTORY OF AMERICAN MEDICINE

PART III

A Brief Sketch of the Rise of American Medical Societies

W. B. McDaniel, II, Ph.D.

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PHILADELPHIA, PA.

In 1958, some 223 years after the founding of the first American medical society of record, the medical profession in the United States would seem to be, in this respect, the most completely organized of all the professions. The organizational pattern is a complex one, in accord with the complex structure of modern medicine. At the apex is a national association of our physicians—the American Medical Association—which rests on a foundation of state associations representing, in all, nearly 2000 county societies, some of which are subdivided into branches. There are, further, approximately 200 national or interstate societies, and a vast number of local ones, most of them dedicated to the furtherance of some special branch of medicine or to larger regional interests. There is a handful of local general medical societies only tenuously related to the major organizational complex, and, finally, there are the local coteries in which professional, and cosmic, matters are discussed and settled in armchairs.

Professional organization obviously waits on the accretion to a community of practitioners (one may do) with enough sense of professional isolation to seek to bring together those with the common bond of professional interest. When knowledge of physical facts was small enough for the educated man to be a philosopher, the "philosophical" society brought him into communion with those who, like himself, took all knowledge—including, of course, medical knowledge—for their province. This was, by and large, the intellectual situation in the seventeenth century, during which the earliest permanent settlements on the North American continent were made. There were at the time a small number of medical societies in Europe, but

Part I of this Symposium appeared in the June issue; part II, in the July issue.

this form of professional organization was not to reach an actively proliferative stage until well into the eighteenth century. Pioneer settlements in a new world are not customarily expected to improvise immediately extensions of the intellectual horizons of the old world; yet, so early in the eighteenth century came the first attempts to form medical societies in the American colonies that we are tempted to attribute their genesis as much to new experience as to time remembered.

Massachusetts, New Hampshire, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, and Georgia—the "original 13." To these pioneer settlements, their populations composed initially of adventurers, the religiously dedicated, and a handful of ambidextrous philosophers, we look, naturally, for the burgeoning of the professional spirit in the new world. And we find it first manifested there in the Massachusetts Bay Colony, in the profession of medicine, and in the form of a medical society.

MEDICAL SOCIETIES BEFORE 1760

On Feb. 18, 1736, William Douglass, a leading Boston physician who had obtained an M.D. degree at Leyden in 1712, wrote to his fellow Scotsman scientist Cadwallader Colden, of New York:

> . . . We have lately in Boston formed a medical society, of which, this gentleman [Dr. Clark, the bearer of the letter], a member thereof, can give you a particular account. We design from time to time to publish some short pieces; there is now ready for the press number one with this title-page:
>
> Number One,
> MEDICAL MEMOIRS
> containing
>
> 1. A miscellany. Practical introduction.
> 2. A history of the dysentery epidemical in Boston in 1734.
> 3. Some account of a gutta-serena in a young woman.
> 4. The anatomical inspection of a spina ventosa in the vertebrae of the loins in a young man.
> 5. Some practical comments or remarks on the writings of Dr. Thomas Sydenham.
>
> *Published by a Medical-Society in Boston, New England*

This volume of medical memoirs, so circumstantially outlined, was never published, nor, in fact, did this first born of our medical societies long survive: the last known contemporary reference to its existence was made in 1744. It may reasonably be supposed that Dr. Douglass and Dr. (presumably, John) Clark had as fellow members of the society the other two important Boston physicians of the day, Silvester Gardiner and Zabdiel Boylston. Drs. Douglass, Gardiner, and Boylston were all exceptionally able physicians, and men of notably strong character. Of Dr. Douglass, for one, it was wittily said that he was always positive and sometimes accurate. While an organization needs for its composition and continuous growth, among other things, strong characters, it also needs a large enough leaven to absorb them comfortably. Our colonies in the eighteenth—our states in the nineteenth—centuries did not lack strong characters; what they were somewhat short on was leaven.

Numerous references to it as the second medical society in the North American colonies obliges us to defer momentarily to a group in New York cited as a Weekly

Society of Gentlemen. A manuscript notebook of the learned John Bard in the library of the New York Academy of Medicine, dated 1749, contains a medical essay whose winding title tells us that the essay "was drawn up at the request of [this society] and addressed to one of them at their meetings." Curiously, in view of the fact that societies of gentlemen interested in the whole range of science were by then functioning under similar elastic names, not until the last decade did anyone question the flimsy evidence on which this society long ago entered the historical literature as a medical society. In 1948, Annan pointed out that there seems to be no real foundation for such a conclusion. "It is hardly likely," she said, "that Bard would have neglected to describe it as such, and the lack of any mention of such an organization by Cadwallader Colden . . . makes it even less likely."

A slightly more plausible, but still dubious, candidate for the honor of an attempt to found the country's second medical society is a group of eminent physicians who met in New Haven, Connecticut, in 1739, while the Boston society was still in existence, elected a chairman, remained in session for two days, and then, unable to agree on a program, adjourned *sine die*. Again, we find that the "Faculty of Physic" in Charleston, South Carolina, was organized as early as 1755 under the presidency of John Moultrie, who had been graduated M.D. at Edinburgh in 1749. Whereas the Boston society, in addition to seeking to obtain a system of licensing practitioners, was interested in publishing memoirs and observing surgical operations, the Charleston faculty appears to have been primarily concerned with the "better support of the Dignity, the Privileges, and Emoluments of their Humane Art," and its agreement that physicians should collect fees at each visit aroused a furor in the press. Its life, too, was brief.

These early attempts to form medical societies, although almost inevitably abortive, intimate the motives that gave rise to them and that were to become increasingly strong as the colonies continued to grow. Although before the middle of the eighteenth century there was in each of the important colonial centers a nucleus of European-trained physicians, the early pioneer standards of medical practice necessarily continued to flourish—and more menacingly as populations increased out of proportion to the number of ethical, well-trained physicians. The mountebank is an ancient, familiar figure in the chronicles of all the arts, trades, and sciences, but a particularly ill-favored one in the history of medicine. By 1753, it was being said of the medical situation in New York: "That place boasts the honor of above forty gentlemen of the faculty, and far the greatest part of them are mere pretenders to a profession of which they are entirely ignorant." In the absence of effective laws regulating the practice of medicine, and with medical education still confined to the preceptorial system, the medical society afforded the reputable physicians their only means of professional communication, their only hope of controlling the forces working against their professional interests. The concepts of the medical society they held were logical enough, but the realization of them awaited a maturity, political and human, that was to be hard-won.

MEDICAL SOCIETIES FROM 1760 TO THE REVOLUTION

The French and Indian War (1756–1763) provided the first opportunity any large

number of our physicians had had of sharing medical experiences and of becoming acquainted with British military medicine. Hindle said:

> The eyes of many were opened, especially of those who had had no academic training. They were exposed to a much better trained and organized profession in which certain standards of performance were insisted upon. All the Americans came to recognize more clearly their need of better education and of regulations which would bar the incompetent from practice. War experiences coupled with post-war patriotism and enthusiasm for organizing led to surprising activity.

Certain it is that the decade of the 1760's was a remarkable one in the history of American medicine. During this period there returned to the colonies of Pennsylvania, Massachusetts, Virginia, New York, Maryland, and South Carolina, armed with the Edinburgh M.D. degree, a group of young and ambitious physicians including such later distinguished medical figures as William Shippen, Jr., Benjamin Rush, John Morgan, Samuel Bard, Adam Kuhn, Arthur Lee, Gustavus Brown, Peter Fayssoux, and Walter Jones. It was in this decade, and in part through the instrumentality of some of these men, that the first medical school in the colonies was opened in Philadelphia, and a second one, in New York. The decade also witnessed the founding, among other medical societies, of the oldest existing one in the United States.

In 1765, there was what appears to have been the first attempt to form a medical society outside urban limits. This was made by Cotton Tufts, a prominent physician of Weymouth, Massachusetts, not far from Boston. It was, of course, an unsuccessful venture, but worthy of note as indicating the need felt even then for some organization of country practitioners. A year later, John Morgan, but three years out of Edinburgh, after earlier service as a surgeon in the French and Indian War and only a few months after his successful launching, in Philadelphia, of the colonies' first medical school, started that city's first medical society, the Philadelphia Medical Society. Its membership comprising most of the leading physicians of the city, this society merged, in 1768, with the American Society for Promoting Useful Knowledge (now the American Philosophical Society). This premier Philadelphia medical society is not to be confused with a society of the same name that was organized in 1789 and lasted until 1868.

The 1760's saw three further attempts by Connecticut physicians to organize medical societies: one at Norwich in 1763; another at New London in the same year; and the third at Litchfield in 1767. Stookey's recent publication of records of this last, almost legendary, society, the Medical Corporation of Litchfield County, which continued in existence until at least 1771, provides us with almost the only comprehensive documentation we have on the struggles of the pre-Revolutionary medical societies. The sad lack of documentation applies fully to a society that was apparently functioning in New York at this period. In his introductory lecture (1767, but not published until 1769) at the opening of the second medical school in the colonies, under the auspices of King's College, Peter Middleton said that the school "was first planned and concluded upon in a medical society now subsisting in this place, and may it long subsist." This reference unfortunately constitutes the only known record of the society, which some writers have identified with the Weekly

Society of Gentlemen, of 1749, accepting the assumption that the latter was a medical society.

The decade is most notable, in this respect, for the organization of the New Jersey Medical Society (now the Medical Society of New Jersey), which represents the first attempt to establish a province-wide organization of the profession and to form a program embracing all the matters then of highest concern to the profession: regulation of practice; educational standards for apprentices; fee schedules; and a code of ethics. Although its meetings were suspended during the Revolution, and its postwar course was bedeviled for some years by a rebellious member's organization of a rival society, the Medical Society of New Jersey survived all obstacles and remains the oldest medical society in the United States.

The rising political storm perhaps accounts chiefly for the fact that the medical society movement languished in the years immediately preceding the Revolution. There are records—as usual, only tenuous ones—of but two medical societies formed in the years 1770–1775. Both, curiously but significantly, were organizations of medical students. An earlier society of this sort, composed of students at the Pennsylvania Hospital in Philadelphia, is predicated by a presidential address contained in a manuscript notebook, dated 1767, kept by one of the students—John Archer, a member of the first class to be graduated from the recently founded Medical School of the College of Philadelphia (now the University of Pennsylvania). Although the Harvard Medical School was not founded until 1782, a number of the College's students studied medicine privately with Joseph Warren and, in 1771, formed a society that owned a skeleton and dissected animals. Two years later, the medical students in Philadelphia felt that they would obtain additional benefits from association in a society, and so formed one, naming it the American Medical Society. Its officers were evidently chosen from the faculty, for the illustrious William Shippen, Jr., is recorded as having been the president in 1790, two years before the society went out of existence.

Thus, in the four decades immediately preceding the Revolutionary War, there had been attempts to form medical societies in Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, and South Carolina—in cities, in towns, in counties, and, in one instance, on a province-wide basis, by both physicians and their students. The motives, except in the case of the student societies, were to regulate the practice of medicine and to provide a regular means for professional intercourse. If the time was not yet ripe for the enforcement of such regulations, especially in a country increasingly dedicated to the spirit of independence, the attempts ought to have been made, they were made, and the many failures may be regarded as merely a necessary and courageous prelude to the successes that were to come as the colonies adjusted themselves to interdependence as the United States of America.

FROM THE WAR TO 1800

The War of Independence was not yet over before the medical society movement was resumed. In 1779, in fact, a Medical Society of Sharon, Connecticut, was launched by a group of physicians from that state, Massachusetts, and New York,

with the announced aim of uniting the members, adding life to the healing art, suppressing quackery, and encouraging medical knowledge. Apparently the first of the interstate societies, it proudly described itself to Benjamin Franklin as "the First Medical Society in the Thirteen United States of America," by which it presumably meant that it was the first to be organized after the Declaration of Independence. This fact, however, was not enough to ensure it a more propitious fate than had fallen to the lot of all but one of its predecessors. In the next year, 1780, Boston's leading physicians organized a Boston Medical Society, which was concerned primarily with the regulation of local fees. There was considerable jealousy among its distinguished members—unfortunately, ever a grave and gravid counter-melody in the history of a naturally tense profession—and the society was soon superseded by the Massachusetts Medical Society, incorporated in 1781 and now the oldest medical society in the country with a record of uninterrupted meetings.

After the war, the movement naturally accelerated. For the next century or so, there continued to be numerous failures, suspension and reorganization, mergers, but also there were founded societies sufficiently well grounded in need and sense of realities to be maintained for lengthy periods, some of them even into the present time.

The energetic Connecticut physicians may also claim to have founded, in the Medical Society of New Haven County, 1784, the first postwar American medical society. This society has the further distinction of having published—its *Cases and Observations*, 1788—the first collection of medical papers in the United States, thus bringing to fruition a design of our firstborn medical society that was then quickly adopted by the Massachusetts Medical Society, with its *Medical Papers*, 1790, and by the College of Physicians of Philadelphia, with its *Transactions*, 1793, the three establishing a precedent that has been widely followed by the more important of our medical societies ever since.

In January, 1787, four months before the Federal Constitutional Convention met in that city, the College of Physicians of Philadelphia held its first stated meeting. The first of the American medical societies to recall in its name—and by reason of the fact that the more active of its founders had been British-trained—the colleges of physicians of London and Edinburgh, this organization is now the oldest of our relatively few large, local medical societies of general character remaining outside the part of the complex commonly referred to as "organized" medicine. The library started by the Massachusetts Medical Society in 1782, when it was a similarly rather exclusive body, has long been a cherished component of the great Boston Medical Library. The Philadelphia physicians began their library in 1788, a year after the founding of the college. Its cultivation has remained from the beginning one of the chief objects of the fellows of the college, with the result that the country today owes one of its major medical research libraries to this venerable society. A third great medical library was to arise from a similar source in the next century, when the New York Academy of Medicine was founded, in 1847. The survival of the College of Physicians of Philadelphia appears the more remarkable when one considers the high mortality rate of medical societies, even in that influential medical center: of at least five medical societies formed there in the eighteenth century, it is the only one to have maintained continuous existence into the present.

Most of the others of the original states soon followed the lead of Connecticut, Massachusetts, and Pennsylvania after the war. Surviving records indicate that British surgeons in the force occupying New York in 1782 maintained a medical society. But the first American medical society organized there after the war was the Medical Society of New York, which was formed in 1788 but dissolved in 1794. It was followed in the same year by the Medical Society of the State of New York, but in 1806 this society was reorganized and more appropriately named the Medical Society of the County of New York.

In 1789, the Medical Society of Delaware and the Medical Society of South Carolina began vigorous careers. In Maryland, a medical society is said to have been organized in Baltimore in 1788; another, the Harford Medical Society, in 1797; while the still extant Medical and Chirurgical Faculty of the State of Maryland dates from 1798. To the north, the New Hampshire Medical Society was organized in 1791, and in the following year, after a long struggle, the Connecticut physicians finally won corporate status as the Medical Society of Connecticut. By 1800, therefore, 65 years after the first attempt was made, in Boston, all but Rhode Island, Virginia, North Carolina, and Georgia, of the original 13, had experimented with the formation of medical societies. Rhode Island joined the procession in 1813; Virginia, in 1820; North Carolina, in 1800; and Georgia, in 1804. Vermont, the first state admitted to the Union after the original 13, had a state medical society in 1813.

THE NINETEENTH CENTURY

As the nation expanded in the nineteenth century, the problems of the medical profession increased in all dimensions, and the need for medical societies was felt in all directions. They were formed in such profusion, at all population levels, encountered such vicissitudes, and often such quick oblivion that no one has yet ventured an attempt to render an orderly, comprehensive account of this particular movement. Some indication of the hazards of such an attempt is afforded by the case of Virginia, which was the scene of the first permanent British settlement in North America (1607) and yet did not produce a medical society until the third decade of the nineteenth century.

On Dec. 15, 1820, 17 physicians of Richmond and Manchester, Virginia, met and formed themselves into a society "to be styled the Medical Society of Virginia." In January, 1824, the society was incorporated; in November of the same year it held its last meeting. The "sudden and unexpected though temporary demise," it was held, "must be found in the apathy and indifference which most unaccountably palsied the exertions of the profession."

The demise, although temporary, long maintained the face of permanence, for it was not until 1841 that the body was revived. Until 1852, the society was essentially one of Richmond physicians. In that year, after considerable pressure exerted by members of the profession inside and outside of that city, the society was reorganized in such a way as to confer greater validity on the name under which it had sailed. Even so, there was, in 1859, a second temporary demise. The apparent death this time "was caused not by the approaching war but by an insistence upon a resolu-

tion advocating a board of medical examiners." In 1870, the society was once more brought to life, and now successfully, for this is the Medical Society of Virginia, still flourishing. Exhibiting a restraint rare in institutional annals, it dates its founding from the year of the second resurrection.

Then, the expansion of this society in 1852 into a statewide organization induced a group of Richmond physicians to fill the resulting local void by the formation of a new society, the Medico-Chirurgical Society of Richmond City. Attracting to its membership never more than about half the physicians of Richmond, however, it existed precariously for three years and then quietly slipped into limbo. In 1866, a new attempt was made to bring the Richmond physicians into professional communion, this time through the agency of a society called the Richmond Academy of Medicine. After a promising start, interest in scientific matters yielded gradually to indulgence in long ethical harangues. In protest, some of the members formed a rival society, the Richmond Medical and Surgical Society, in 1880. Ten years later, a union of the two societies was effected, the resulting body being termed the Richmond Academy of Medicine and Surgery. This distinguished society is known today, of course, as the Richmond Academy of Medicine.

CONCLUSION

Although performances of this sort continued to be characteristic of the medical society movement throughout the greater part of the nineteenth century, there were at the same time in motion two developments that were destined to lead eventually to greater stability on this front and, indeed, to an extraordinary extension of it. The primary function of most of the early societies, as has been indicated, was to stimulate the adoption of medical legislation and, in time, to enforce it. During the first half of the nineteenth century, the societies' regulatory powers came to be assumed by the states, one after another. This left the societies free to concentrate on their other interests. These other interests—predominantly, needed reforms in medical education—advanced the idea of a national organization that could also serve to counterbalance in a measure the loss of regulatory powers. With no less severe labor pains than many an obscure and quickly defunct local society had experienced, the American Medical Association was organized in Philadelphia in 1847. Its immediately quickening influence is evidenced by the fact that between its organizational meeting and its first annual meeting, held a year later, new state societies were organized in South Carolina, Alabama, and Pennsylvania, while old ones in Georgia, Mississippi, Tennessee, Ohio, and Wisconsin were greatly invigorated. In turn, new county societies were quickly formed, with national, state, and county societies deriving strength and stability from one another.

The other major contributing factor to the stabilization and multiplication of medical societies was, of course, the rise of specialization, which may be said to have had its small beginnings, at the practical level, in the divisions of medical knowledge recognized in the curricula of the medical schools.

The first society in the country formed for cultivation of one of the basic medical specialties was an American Physiological Society founded in Boston in 1837. It

lasted approximately three years. In 1839, a Philadelphia Pathological Society was started, but it had an equally short life. In 1844, there was founded, also in Philadelphia, an organization called the Association of Medical Superintendents of American Institutions for the Insane; its current, and more manageable, name is the American Psychiatric Association. The real flowering of the specialized society, however, did not take place until after the Civil War. By the close of the century, at least 14 of our present national specialized societies had been organized, in addition to a much larger number of local specialized societies. The continuing fractionalization of medicine in the present century has been, and obviously will continue to be, countered in the most natural way—by the formation of new paramedical societies.

The history of each aspect of human endeavor has themes that are common to all, the themes being contributed by the basic qualities of man's own nature. We meet them in the history of medicine and in each important segment of it. Apathy, uncontrolled ambition, greed, contentiousness appear endlessly in the history of American medical societies. Yet here they are in abundance, bringing us great journals, great libraries, and the great blessing of personal communion.

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The Nineteenth Century American Physician as a Research Scientist

Phyllis Allen Richmond

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The amount of basic or fundamental research carried on in the United States during the nineteenth century was considerably greater than most authorities would lead one to believe. The so-called American neglect of work in "pure" research, as opposed to "applied" research, was an interpretation accepted by those wishing to raise educational standards by following the pattern of German institutions. This was a revolt against the ever-present American emphasis on the practical, and it affected those who wished to improve research facilities, such as Simon Newcomb and William Henry Welch, as well as educators. The viewpoint persisted, notably in the surveys of Abraham Flexner, and it is still with us today, recurring periodically in articles and newspaper stories deploring the dependence of American science on foreign ideas.[1]

There is, of course, considerable justification for such an attitude. American research results in the nineteenth century were very poorly publicized. Most astronomers, for example, found it advisable to publish their results in English, French, Italian, and German journals as well as in American ones, in order to secure some degree of recognition. Americans who published only in native periodicals ran the risk, as did Josiah Willard Gibbs, of having their work repeated unnecessarily abroad. In contrast, the contributions of inventors were widely published and praised, despite the fact that without basic research such developments would have been impossible. There has also been a tendency to compare American research results with those of "Europe," or with France, Germany, and Great Britain as a unit, which would cause any *single* country to make a poor showing. Furthermore, great theoretical advances have been sought in scientific fields such as chemistry and physiology, where not much was done, instead of in areas such as astronomy and geology, where much was accomplished.[2]

In the field of medicine all of these comments are pertinent. There was a very strong pragmatic outlook, centering on practice as the basis for a physician's prestige. Very little research was published outside of American journals, thus limiting its influence. American results have been deprecated because they are not impressive when compared with those of Britain, France, and Germany simultaneously. Finally, practically all of the significant work in American medicine lay in observational fields. Hardly any laboratory science of importance came from America, probably because until very late in the century there were few laboratories. In this latter case the educators were certainly correct in their attempt to remedy matters. The formation of laboratories was an important advance in the promotion of American science.

Portraits courtesy of the National Academy of Sciences.

The American physician, fortunately, did not feel limited in his research to the field in which he had been trained, and many contributed to areas other than medicine. Indeed, some, such as Asa Gray the botanist, did not practice medicine at all. Almost half of the American scientists who made significant research contributions during the nineteenth century were physicians. Considering the low state of medical education during most of the century, this was quite startling.[3] A good proportion of these men, though by no means all, had taken a Bachelor of Arts degree before embarking upon the medical course. A very few, notably William Beaumont, whose work on digestion is well known, lacked even a degree from a one year medical school.

It must be emphasized at this point that the type of research under discussion was that of a fundamental nature. This usually means theoretical studies or research needed to bring the theoretical structure of science into line with experimental or observational results, as well as research motivated primarily by curiosity. Although it seems a little difficult to believe in retrospect, in its day much of this endeavor was the equivalent of modern "blue sky" research. For example, the cryptogamous theory of John K. Mitchell, of Philadelphia, in the prebacteriology period or the taconic system of Ebenezer Emmons in geology certainly fit into this category. Research in applied science, especially that directed at solving specific practical problems, has not been considered. Most surgical procedures fit the latter category. However, when a surgeon experimented scientifically in developing techniques, as did Marion Sims in gynecology and William S. Halsted in several areas, then his work has been considered basic. The distinction is rather fine, but none the less important since it reflects a fundamentally different attitude.

American contributions to basic research in medicine were mostly in the realm of differential diagnosis. This reflects American initial concern with practice, as well as reliance on systematic observation as the method of choice. The disease or diagnostic sign that resulted from differentiation very often has been named after its discoverer. Some examples are: Bannister's disease (acute angioneurotic edema), Baruch's law (sedative effect of tepid bath), Beard's disease (neurasthenia), Fitz's law or syndrome (acute pancreatitis), Flint's law (elevation in pitch accompanies lowering of resonance in pulmonary consolidation), Flint's murmur or sign (murmur at apex in aortic regurgitation), Gross's disease (encysted rectum), Hand-Schüller-Christian disease or syndrome (Hand's disease was an early name for hypophyseal xanthomatosis), Hersman's disease (progressive enlargement of the hands), Hoppe's disease (myasthenia gravis paralytica), Huntington's chorea or disease, Koplik's spots or sign (exanthemas on buccal membrane in measles), McBurney's point, Mitchell's disease (erythromelalgia), Morton's disease (metatarsalgia), Osler's nodes, signs, or spots (swellings in hands and feet in malignant endocarditis), Osler's syndrome (effect of ball valve gallstone in common duct), van Buren's disease (hardening of the corpora cavernosa—codiscoverer, E. L. Keyes).[4] With the exception of Flint's law, Osler's sign and syndrome, and Hoppe's disease, all these discoveries were announced first in American medical journals.

Other disease entities that do not bear the names of their discoverers were also identified by American physicians. Danielson and Mann in New England first de-

scribed a form of sleeping sickness in the United States, and Elisha North identified cerebrospinal meningitis. John Conrad Otto studied a family of hemophiliacs, pointing out the hereditary features of the disease. John Ware of Harvard added work on delirium tremens. Three men who studied in France were prominent in differential diagnosis: W. W. Gerhard of Philadelphia first distinguished between typhoid and typhus fevers; Elisha Bartlett carried his work further and added yellow fever and malaria to these two; and Nathan Smith wrote a classical account of osteomyelitis. James Jackson of Boston, who had studied in England, described a neuritis "resulting from the use of ardent spirits." Reginald Heber Fitz, also of Boston, recognized the true nature of appendicitis and coined its name. He also identified acute pancreatitis. In California, Emmett Rixford, with his assistants Walter S. Thorne and Thomas C. Gilchrist, described coccidioidal granuloma (coccidioidomycosis), a peculiarity of the San Joaquin Valley. All of this work was published in American medical journals.

The study of disease processes was a companion to differential diagnosis as a field for research in nineteenth century America. Oliver Wendell Holmes's clear-sighted explanation of the factor of contagion in puerperal fever is familiar, as is the definitive study of the transmission of yellow fever by Walter Reed and his associates. William Henry Welch's "Adaptation in Pathological Processes" was a landmark.[5] Horatio C. Wood, whose occupancy of several University of Pennsylvania Medical School professorships caused Oliver Wendell Holmes to quip that some professors held "not a chair but a settee," was a research man of capability. He made an important investigation of sunstroke and a serious basic research study on fever.[6] He also studied drugs, prepared a standard classification of them, and isolated hyoscine, an alkaloid of henbane. Fundamental research in two major fields of medicine was unusual, so that the University of Pennsylvania was probably well advised to give Wood his settee.

Anesthesia was a field in which American physicians pioneered. Samuel Guthrie discovered chloroform and Crawford W. Long pioneered in the use of ether. Neither one *established* the application of his anesthetic and neither received the ultimate credit for his discovery. Although physicians were slow to appreciate the advantages of ether anesthesia and the value of the discovery had to be established by dentists, at least the profession was spared the disgraceful battle over priority that took place among these dentists. Research yielded other types of anesthesia, notably the nerve-block types. Howard A. Kelly and William S. Halsted (independently) experimented with cocaine.[7] Dr. Halsted had the tragic experience of discovering through self-experimentation that this drug was habit-forming. His conquest of the narcotic habit was an epic of courage.

Pure research in surgery took the form of systematic experimental operative procedure. James Marion Sims, in the preanesthesia days, purchased slaves and perfected his operation for vesicovaginal fissure on them before using it on his regular patients. Dr. Halsted, at Johns Hopkins, became noted for his very gentle handling of tissues and dissection-like operative technique. Anesthesia afforded time for this, in contrast to the speed required before this refinement. George Crile in Cleveland conducted experimentation on surgical shock, developing an exhaustion theory of

shock, which was of some interest in surgery. Experimental procedures on animals became standard for surgical research. The rise of such practices necessarily paralleled the growth of laboratories. By the end of the nineteenth century, laboratories were becoming increasingly common, and experimental techniques quite modern.

Other fields of investigation included neurology, medical geography, and the sciences now called preclinical. Early neurological studies had been carried out by S. Weir Mitchell of Philadelphia. With two local colleagues, George Morehouse and W. W. Keen, he made an extensive study of traumatic neuroses, as well as nerve injuries from gunshot wounds and other sources. Mitchell's contributions included research on the physiology of the cerebellum, nerve injuries, postparalytic chorea, and the place of rest in the treatment of nervous diseases. A Southern contemporary, Henry F. Campbell, produced a theory of secretion of nerves, which was of passing interest.

One of the more unusual American research efforts took place in the field of medical geography. Daniel Drake, a peripatetic Middle Western medical educator, brought out what was probably the first serious work in this field since the days of Hippocrates. His *Diseases of the Interior Valley of North America* is still a very readable book. The progress of medicine has rendered some of this material obsolete—malaria, for instance, is no longer a major problem in most of the area—but other points are still pertinent. The relationship between geographical factors and disease was shown in its true importance. Since Dr. Drake's time, medical geography has prospered, and one branch of it, epidemiology, has proved extremely valuable.

Research in the preclinical science of anatomy was centered in Philadelphia. John Godman produced a major work on the fascia of the human body and another on pathological anatomy.[8] William E. Horner studied the anatomical changes in cholera, while Samuel D. Gross wrote the first treatise on pathological anatomy in English.[9] Joseph Leidy contributed a careful study on the articular cartilages.[10] The other chief anatomical study of interest came at the very end of the century. This was Frederick B. Robinson's work on the abdominal brain and the automatic visceral ganglia. Dr. Robinson, a Chicago surgeon of considerable ability, made several other discoveries and surgical improvements, but the research on the abdominal brain is one of the more significant American contributions to anatomy.

John Jacob Abel, professor of physiological chemistry at Johns Hopkins, isolated adrenalin, and became the first American contributor to the new field of biochemistry. Dr. Abel, who had been educated at Michigan, Johns Hopkins, and Strassburg, was one of the talented physicians chosen to teach in the preclinical fields at the new Johns Hopkins Medical School. He and his contemporaries, Franklin P. Mall, Ira Remsen, Drs. Welch, Kelly, Osler, and Halsted, were all qualified research workers. In turning out scientists like themselves, they prepared the way for twentieth century American medical research.

In the field of science, the nineteenth century was an era of transition. As in medicine, research methods were largely observational until the development of laboratories toward the end of the century. The areas of science that prospered most were those in which such simple techniques were paramount—geology, astronomy, and botany.

American physicians contributed to pure research in every field of science except mathematics. As one might expect, the biological sciences received much more attention than the physical ones. A few talented physicians operated in several fields, notably the Swiss-born natural historian, Louis Agassiz, in geology and zoology, Elisha Kent Kane, the U. S. Navy's Arctic explorer, in astronomy, meteorology, geology, and oceanography, Joseph Leidy in geology and zoology, and William Henry Welch in bacteriology and zoology. Drs. Leidy and Welch were also contributors in the field of medicine.

The physicians who undertook research in the physical sciences were not, for the most part, engaged in practice. Some, like Joseph Leidy and Ebenezer Emmons, taught in medical schools. Most of the others left the field of medicine completely and concentrated their efforts on scientific pursuits. The exception to this rule was David Alter of New York, who was both a physician and a physicist and is noted for his pioneering work in spectrum analysis.[11]

Some physicians had very broad interests. Elisha Kent Kane, during his short career with the Navy and Coast Guard, made major contributions to knowledge of the Arctic in astronomy, geomagnetism, meteorology, and oceanography. Others concentrated in a single area. The physician who became an astronomer, Henry Draper, blazed new paths in photography of planetary and stellar spectrums. One of the most illustrious of all American research workers was Ira Remsen, the organic chemist. Almost immediately after taking his degree in medicine at Columbia, Dr. Remsen went to Göttingen to study. During his stay in Germany, he made the famous synthesis of saccharin. On returning to America and a professorship at Johns Hopkins, Dr. Remsen undertook a multitude of research projects, including study of the sulfinides (where he postulated a new class of substances and then found them), the theoretical explanation of halide combinations, and research on the oxidation products of aromatic hydrocarbons. Most of the present generation of senior organic chemists were trained by students of Dr. Remsen.[12]

The field of physical science in which the most research was being done in America during the nineteenth century was geology. As might be expected, American physician-geologists took part in the progress. The work of Louis Agassiz on glacial theory is well known. Another early and influential geologist was Ebenezer Emmons, one-time professor at the Albany Medical College. The taconic system, which Emmons outlined in his geological history of the Second District in New York, caused great and heated discussion in geological circles. Dr. Emmons thought this group of rocks belonged to the Cambrian age, but eventually it was shown to be Lower Silurian.[13]

Joseph Leidy's fame as a geologist lay in the field of paleontology. After the Civil War, he accompanied the Hayden Expedition (United States Geological and Geographical Survey of the Territories, 1867–1878) to the West, and as a result of his field observations he produced three memoirs on extinct fossils that have never been surpassed. Dr. Leidy unfortunately was forced out of paleontological research by the wealthy collectors, Henry D. Cope and O. N. Marsh, who bought up all the fossils.[14]

John Strong Newberry, who took part in several of the state and Federal geological

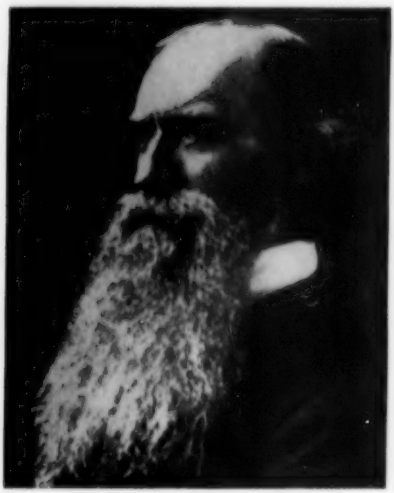
surveys and later taught at Columbia, was noted in the field of subaerial erosion. He established the doctrine first suggested by a Swiss, Horace B. de Saussure, that valleys are formed by streams. Heretofore these land forms were supposed to have been fissures in the earth as it dried out after the Flood. Newberry also pointed out the cyclic nature of deposition in periods of geological time, a proposition taken up by later geologists and used for systematic explanatory description, comparison and interpretation of the earth's features.[15]

Joseph Le Conte, a contemporary of Drs. Leidy and Newberry, went to California after the defeat of the Confederacy and studied the mountain ranges in that area. He was especially noted for the contraction theory of mountain building, the tensional hypothesis (for faults), the critical periods doctrine (short periods of rapid change alternate with long periods of relative stability), the elevation theory of glaciers, and for work on earth crustal movements and the origins of mountain ranges.[16]

Dr. Leidy was professor of anatomy at the University of Pennsylvania Medical School, but Drs. Newberry and Le Conte both held academic positions in nonmedical fields. Apparently, in the 1840's, when all three were students, sufficient scientific training and motivation were being imparted in colleges and medical schools to inspire some students to undertake research careers in science. At that time, geology, where field work was almost entirely government-subsidized, was the subject of choice. There is no common denominator in the education of these three men, as all attended different arts and medical colleges.

One might expect a medical degree to lead to research in the biological rather than the physical sciences, and this was the case. There were three times as many physicians engaged in research in this area. Furthermore, the physicians involved in

Ira Remsen (1846–1927).



John Strong Newberry (1822–1892).

biological research were more likely to practice than those who turned to physical science. The fields of botany, especially bacteriology, and zoology received the most attention.

In botany, Jacob Bigelow, of the Harvard Medical School, wrote a comprehensive three volume *American Medical Botany*, one of the first of its type. A New York contemporary, John Torrey, compiled major descriptive works on the flora of North America, making large and comprehensive use of the natural system. In this work Torrey was assisted by a young physician-botanist, Asa Gray, who was eventually to become the dean of American botanists.[17]

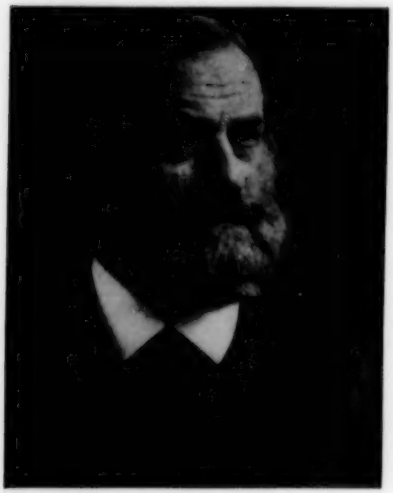
Asa Gray, a graduate of the Fairfield Medical School, joined the faculty of Harvard and worked exclusively as a botanist. His principal research, on which he worked most of his life, concerned the relationships between North American plants and those of northeast Asia. He surveyed the characteristics of North American flora and related them to other continental floras in a manner never surpassed. In addition to this major effort, he wrote several general botany books, made classification studies, and carried on an important correspondence with other scientists, notably Charles Darwin, whose theories on evolution he promoted in America. Dr. Gray was one of the few nineteenth century Americans to be invited to join the Royal Society.[18]

Several physicians from Europe migrated to America and contributed to American scientific research. Louis Agassiz of Harvard has already been mentioned. Others were Henry N. Martin, a physiologist from England, as well as the German-educated psychologist, Hugo Münsterberg, zoologist Jacques Loeb, both to be discussed later, and George Engelmann, a botanist. Dr. Engelmann, for whom the beautiful Engelmann spruce is named, practiced medicine in St. Louis. His scientific research was an avocation. He described a new species of buffalo grass and wrote on the genus *yucca*, but his real efforts were directed toward study of the conifers of the Rocky Mountain region, and it was in this field that he excelled.[19]

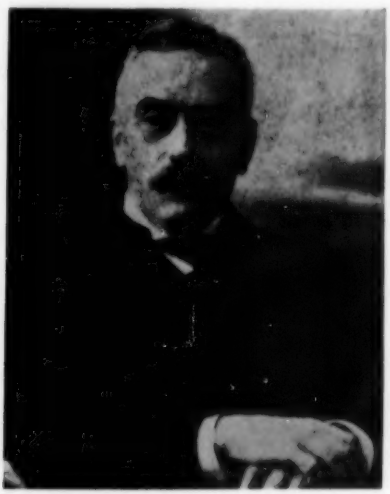
Bacteriology is a field much more closely allied to medicine than botany. However, American efforts in this subject were somewhat limited, in the case of physicians at least, because most of the profession did not accept the germ theory of disease until the early 1880's. John K. Mitchell, of Jefferson Medical College, was an early exception. He had his own fungus theory of disease causation, and while he was on the right track, he was several decades ahead of the rest of the field. George M. Sternberg, later surgeon general of the U. S. Army, accepted the germ theory before most of his contemporaries. It is gratifying to note that in the heyday of bacteriological discovery, Dr. Sternberg independently found a pneumonia microorganism in the same year as Pasteur. Similarly, the ophthalmologist John Elmer Weeks found the bacillus involved in acute catarrhal conjunctivitis simultaneously with Koch. The research of Theobald Smith of the U. S. Bureau of Animal Industry and his co-worker, D. E. Salmon, on artificially produced immunity in hog cholera, and with F. L. Kilborne on the etiology and transmission of Texas fever, is too familiar to be repeated here. It belongs to the golden age of bacteriology (1880–1900), as does the discovery of the variety of *Staphylococcus albus* involved in stitch abscess and the *Bacillus aerogenes capsulatus* of gas gangrene by William H. Welch.[20]

In nonmedical bacteriology, William Gilson Farlow, of Harvard, was a pioneer. After graduation from the Harvard Medical School in 1870, he joined the Bussey Institute, where he carried on research on plant disease caused by fungi, notably onion smut. He and Arthur Bliss Seymour compiled an encyclopedia of the parasitic fungi of the United States, classified according to their hosts. It was only a short step from mycological to bacterial diseases of plants, and Dr. Farlow's students soon took that step. They created an American school of plant bacteriologists, which led the world in this new field.[21]

In the science of zoology, quite a few American physicians found an outlet for their talents. Louis Agassiz developed his theory of biogenetical law (rediscovered by Ernst Haeckel) and elaborated it in several articles and part of a book on classification. Tarleton H. Bean, who was associated with the U. S. National Museum and later the New York Aquarium, specialized in ichthyology. He and George B. Goode of the Smithsonian Institution wrote a famous monograph on deep sea and pelagic fishes of the world. Louis Elsberg, of New York University, introduced the plastidule hypothesis, a contribution to biological atomism. Jacques Loeb, later of Rockefeller Institute fame, began his important work on parthogenesis soon after coming to America. Franklin P. Mall, of Johns Hopkins, contributed very careful studies in embryology. S. Weir Mitchell, the Philadelphia neurologist, wrote on rattlesnake venom and its production. With Edward T. Reichert, a fellow Philadelphia physician, he added a study of poisonous snakes in general. Thomas S. Savage, a Yale clergyman-physician, and Jefferies Wyman, the Harvard anatomist, studied the gorilla at a time when this creature was a rarity. Dr. Wyman alone made a brilliant study of the nervous system of the frog, *Rana pipiens*. His publications were fragmentary, unfortunately, but the research he did publish was beautifully executed.



Joseph Leidy (1823–1891).



William Gilson Farlow (1844–1919).

William H. Welch and William S. Thayer at Johns Hopkins discovered one of the malarial parasites, the *Plasmodium falciparum* of estivoautumnal fever.[22]

The versatile Joseph Leidy made several interesting zoological studies. He found the *Trichinella spiralis* in hog muscle, wrote an early book on parasites, and, an offshoot of his experiences with the Hayden Expedition, produced a classic on the fresh water rhizopods of North America, complete with handsome plates that he drew himself. It is interesting that two classics emerged from this expedition, one in paleontology and one in zoology, both by the same master. Dr. Leidy's final effort was another fine research monograph on helminthology and parasitology, which was published 13 years after his death.[23]

A few physicians were prominent in three fields closely allied to medicine: physiology, psychology, and anthropology. None of the psychologists or later physiologists practiced medicine, although all the anthropologists except C. C. Abbott did so. Most of these men published primarily in American journals.

American research in physiology began very early in the century with the recognition by John R. Young, a University of Pennsylvania graduate, of the acid nature of the gastric juice. Next came William Beaumont, an Army physician, with his walking laboratory, wherein he studied digestion as a chemical process. A long period then followed with no serious research contributions in physiology. A completely different kind of physiologist came in the 1870's with the appearance of the laboratory. Henry Pickering Bowditch was probably the native American who best fitted the European ideal. During his career at Harvard, he devoted himself to laboratory investigation. Before the end of the century, he had received recognition abroad in the form of honorary degrees from Edinburgh and Cambridge. His discoveries included the nonfatigability of a nerve, the law of maximal contraction (all-or-none principle of cardiac contraction), and the treppe or staircase phenomenon (the gradual increase in extent of muscular contraction after rapidly repeated stimulation).[24]

Henry N. Martin, another physiologist of the new type, came from England to teach at the recently formed Johns Hopkins. He devised a method for perfusing the isolated mammalian heart, which has been considered "possibly the greatest single contribution ever made from an American physiological laboratory."[25] The research of Drs. Bowditch and Martin was modern in method and set the pattern for their students and successors.

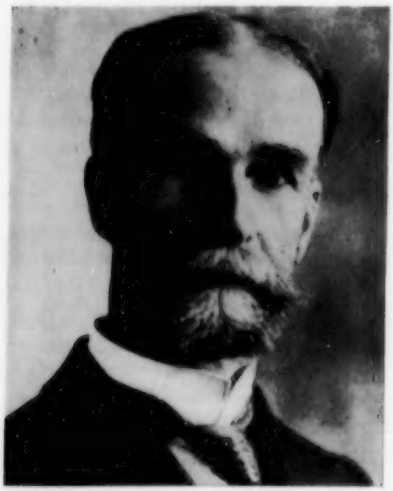
The physicians' contribution to psychology can be measured in quality rather than quantity. William James of Harvard was one of the founding fathers of the subject. His *Principles of Psychology* is still a classic in both psychology and philosophy. This book brought together some of his earlier theories, including the James-Lange theory of emotions and the motor theory of consciousness.[26] Dr. James received many honorary degrees and awards.

Another physician, Livingston Farrand, while professor of anthropology at Columbia, joined with James McKeen Cattell in physical and mental measurements of students, which laid the groundwork for study of individual differences, a specialty of American psychologists. A contemporary, Hugo Münsterberg, came to Harvard from Germany and continued his researches in this country. He was, however,

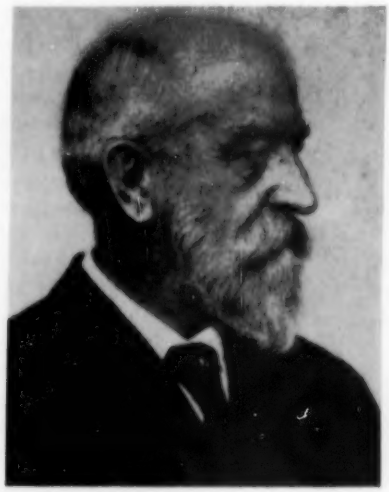
essentially a German scientist in an American setting, and he continued to publish his results primarily in Germany.[27]

Several physicians became proficient anthropologists. Charles Conrad Abbott, a cultural anthropologist, studied the Stone Age man in New Jersey. Daniel C. Brinton, of Philadelphia, was primarily interested in speech and linguistics, and his research on the American Indians was based on linguistic analysis as well as ethnographic description. Edward H. Davis, at the time in practice in Ohio, collaborated with the eccentric Ephraim Squier to study the remains of the Mound Builders and to postulate relationship between their culture and that of Central America. Josiah C. Nott, a Southern physician and physical anthropologist, studied the races of mankind, partly, one suspects, to bolster his views on slavery. With George R. Gliddon, he compiled two important studies on race, introducing a theory of polygenetic origin of the various races of mankind. Although his theory may not be entirely acceptable to present-day anthropologists, his research on the whole was sound. He was one of the first to study race scientifically, and his writings were influential in Europe. Samuel G. Morton, another Philadelphian and a physical anthropologist, studied craniums, first those of aboriginal Americans and then those of ancient Egyptians.[28] It is interesting that most of these anthropologists were educated at the University of Pennsylvania, although any significance is probably purely coincidental since their graduation dates stretch across the entire nineteenth century.

Almost all the physicians who did research in science published their results in American journals. Some material was published at government expense, notably Dr. Leidy's Hayden Expedition work, Theobald Smith's studies, Dr. Bean's work on fishes, and the monographs appearing as the *Smithsonian Contributions to Knowledge*. These undoubtedly commanded attention abroad because of the prestige of official



Theobald Smith (1859–1934).



Henry Pickering Bowditch (1840–1911).

backing. Although American periodical literature may not have been widely circulated in Europe, it apparently was read in the proper places. Many of the physicians mentioned here received one or more honorary degrees from foreign universities, not to mention fellowships and memberships in learned academies and societies, medals and prizes. It seems inconsistent, on the one hand, to say that American pure research in science and medicine was insignificant and unappreciated and, on the other hand, to list the many honors given to American scientists. These honors indicate that there must have been more of a meeting of minds than is generally recognized.

The American physician's contribution to pure research in science and medicine was a significant one. The 87 physicians discussed in the present study represent more than one third of the pure scientists whose work has proved important enough to merit attention.[29] As a group they form a sampling of what the nation could offer during the nineteenth century. Their educational and vocational attainments give some indication of the status of medicine and science in this era.

The educational background of all but five of these physicians has been ascertained. More than half studied at the University of Pennsylvania, Columbia, Harvard, and Jefferson Medical College.[30] The others came from medical colleges throughout the country. As one might expect, the foremost medical schools were in the largest cities, Philadelphia, New York, and Boston. The scientific spirit was being inculcated in these schools, to judge by results, although the medical course in all of them left something to be desired.

It has been said that "until the end of the nineteenth century most of our distinguished scientists were trained abroad"[31]—a statement often repeated in one form or another. This simply is not true. In the present study, 7 of the 82 physicians whose background is known were educated exclusively abroad before they migrated to America. A little more than one third of the rest (32) were trained both in Europe and in America. The remainder (43) were educated solely in the United States. The proportion of foreign to native trained physicians (36.7 per cent) is slightly higher than that of American scientists as a whole (29.9 per cent).[32] It reflects a special situation in the field of medicine: the slowness of the medical educators and the profession as a whole in seeing the value and accepting the results of scientific medicine abroad. The average American physician came to look upon medicine as a science rather than as an art somewhat later than his European counterpart.

Two thirds of the physicians in the present study held academic positions. To some, such as Asa Gray and the nonpracticing physicians, this was the major source of income. Most of the others, however, took on medical teaching as an addition to their practice. In many medical colleges, a physician was not asked to join the staff unless he had already proved his worth through the accumulation of a large practice. The ratio of academic to nonacademic positions among the physicians (70 per cent) was about the same as that for scientists as a whole (66 per cent).[33] This equality is more apparent than real because medical professors did not have to live primarily on their salaries as the scientific professors did, at least until the reorganization of medical education and the institution of full-time appointees in the preclinical medical sciences.

The American pure research scientists were a small but important group, who

produced considerable work of high quality. They pioneered in an unusually large number of virgin fields, such as stellar photography and spectroscopy, geomorphology, plant bacteriology, parasitology, paleontology, psychology, and anthropology. The reason for this was probably inadequate training in the classical fields of science, which would not be a handicap in a new field. For the most part, Americans did what research workers everywhere do—they added their contributions, small and large, each in his own areas.

In medicine, during most of the century, pure research took the form of studies in differential diagnosis. This was largely a matter of accurate and painstaking observation. It could be carried on simultaneously with practice, and for such research a large practice was a help and not a hindrance. No laboratory, expedition, or expensive equipment was required, although good records were a necessity.

By the end of the nineteenth century, research methods were essentially modern, and the addition of funds and laboratories served to accentuate the trend toward greater attention to pure research. Poor publicity for research results was remedied, partly by new means of publication and partly by increasing attention to public relations. In the twentieth century, receipt of Nobel prizes by American medical scientists aided in popularizing the scientific outlook at home and in giving prestige to American science abroad. Comparison of the social position of the physician today and that of 100 years ago indicates the degree to which the profession has risen, primarily due to advances accruing from the adoption of the experimental scientific method. In this process, an important part was played by those nineteenth century American physicians who were interested in pure research in science or medicine. Their contributions deserve to be remembered and appreciated, for they form an integral section of modern scientific knowledge.

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World Federation for Mental Health

The eleventh annual meeting of the World Federation for Mental Health will be held in Vienna, Austria, from Aug. 24 to 29, 1958, by invitation of the Austrian Society for Mental Health. "Uprooting and Resettlement" is to be the general theme, and world-wide problems of refugees and migrants will be considered.

Trends in American Public Health, from the Colonial Period to the Present

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The history of public health is the story of perhaps the most significant social movement of modern times. As a result of this development, for the first time in history, the human lifespan has ceased to be a plaything of Lachesis and has come to an increasing degree under the control of the human will. In the words of Hermann M. Biggs, "within natural limitations, a community can determine its own death rate." A retrospective view of this movement, especially as it has affected the United States, is a matter of considerable interest.

As in Europe, the general health, which in a rural environment received minimal attention, became a matter of public concern as soon as urban communities arose and grew in American colonies. Epidemics were prominent among the situations that precipitated action in the interest of community health, but attention was also given to the location of privies, sewage disposal, water supply, and the provision of medical care. In their approach to such matters, the colonials were imitators, basing their actions on European practices and experience. Furthermore, when considering the efforts of local authorities to solve the problems that confronted them, it is well to remember that they had to operate within the narrow, inefficient framework of town government. Local officials had practically no control over external causes affecting the welfare and health of the community. Then too, there was no permanent health organization in municipal government. Indeed, as in England and in other countries, one of the basic problems involved in the genesis and development of public health in the United States was the need to create an effective administrative machinery for the supervision and protection of the health of the community.

During the first three decades of the nineteenth century, American urban communities grew steadily, if not spectacularly. On the whole, social conditions were favorable in the young republic, and reflecting this situation, public health administration was simple in organization and limited in scope. Between 1800 and 1830 only five major cities established boards of health. Even as late as 1875 many large urban centers had no health departments.

The character of public health organization at this time is well illustrated by the example of New York City. In 1798, an epidemic of yellow fever ravaged the community. Until then the municipality had no authority to issue health regulations, but the need for power to meet such emergencies was recognized by the State Legislature and the city was granted authority to pass its own health laws. A permanent public health administration did not come into existence until the next decade. It may be said to date from March 26, 1804, when John Pintard was appointed city inspector of health. From 1810 to 1838, the health inspectors were a branch of the

police department. Health administration, environmental sanitation, particularly in relation to the control of epidemics, and the collection of vital statistics were the areas within which the city inspector carried out his responsibilities.

Some of the city inspectors were qualified by the standards then current to deal with problems of community health, and a number of these officials recognized the value of accurate vital statistics. Nonetheless, the available administrative machinery was intolerably inefficient. As these positions were much sought after, political machinations played a considerable role in filling them. A consequence was that the officials in numerous instances were highly incompetent and subject to political influence. Furthermore, this situation was aggravated by division of authority. In addition to the city inspector, there was the health officer, concerned with the application of quarantine in the port, the resident physician, responsible for discovering communicable disease, and an advisory board of health, which recommended measures for dealing with health problems.

The situation in other cities was similar in general, if not in detail. Obviously, conditions of this kind did little to foster the growth of efficient public health administration. The existing inefficiencies might be tolerated while social conditions were favorable, but the prolonged intrusion into such a situation of profoundly disturbing elements was bound to throw into sharp focus the basic inadequacy of existing arrangements.

At this very time, however, profound changes in the political, economic, and social life of various European communities were setting in motion a stream of migration that was to upset with violent impact the situation that had obtained during the first three decades of the nineteenth century. The terrific shock produced by the influx of swarms of impoverished immigrants was first felt in the seaboard cities like Boston and New York, where inadequate provision for the increasing complexity of such problems as housing, water supply, sewage disposal, and drainage soon brought into being a whole brood of evils that found their most characteristic expression in the urban slum.

As immigration and population grew rapidly, housing became a pressing problem. Cheap quarters were needed, and the new arrivals found shelter in the older sections of the cities, in private houses, old warehouses, breweries, or any building with four walls and a roof. The development of cheap urban transportation facilitated this process as the better-situated moved to new districts on the urban periphery. Within the old sections, new housing was not generally provided for lower income groups until after the middle of the nineteenth century, and then came the tenement proper, which replaced converted dwellings and other makeshift housing in larger cities. The tenement was originally a multiple dwelling designed to provide cheap housing for the workers, but it soon became synonymous with slum dwelling. Throughout the nineteenth century there was perpetual overcrowding. Such toilet facilities as existed were highly inadequate, and recreational arrangements were nonexistent except for the saloon. Small wonder that disease, crime, and immorality became problems of the slums. City life for a large number of people was sordid and unhealthy, and the significance of such conditions for the community as a whole could not be overlooked.

Meanwhile, contacts with Europe brought knowledge of what was going forward in other parts of the world. Facing slum conditions similar to those in Great Britain and on the Continent, Americans were influenced by points of view and methods already applied there. The pioneer studies of Villermé in France, and the striking reports of Chadwick, Smith, and other sanitary reformers in England, were paralleled between 1830 and 1870 by a series of equally significant inquiries in America. As in Europe, the early public health movement was permeated with a spirit of social reform, and was conceived in its broadest aspects. For example, the physician Benjamin MacCready, in his pioneer essay on occupational medicine (1837), called attention to the miserable living conditions of the workers and their families. More significant is the book by John C. Griscom entitled *The Sanitary Condition of the Laboring Population of New York*, published in 1848. Influenced by Chadwick and the English sanitary reformers, Griscom presented in essence the principles and objectives that characterized the American sanitary reform movement for the next three decades.

Central to this program is the concept of preventable mortality. It was by exploring the associations between living conditions and greater or lesser expectation of survival that the most notable successes in achieving sanitary reforms were won. In general, the miasmatic theory of disease was accepted, but despite the absence of knowledge concerning microbial organisms as materies morbi, it was possible to make an effective attack on the health problems of the community. For this purpose, statistics provided an invaluable weapon.

Catastrophe often precedes and brings into sharp focus the need for social change. In nineteenth century America, and especially during the period under consideration, this element was provided by recurrent epidemics of various communicable diseases —yellow fever, cholera, smallpox, typhoid fever, and typhus fever. While it was recognized that dire poverty, inadequate housing, and unsanitary surroundings took their toll in sickness and lives, this knowledge was dramatically impressed on the public mind by every invasion or outbreak of epidemic disease, and the need for effective public health administration became a matter of terrifying urgency.

Despite increasing evidence of the need for sanitary reform, efforts to change the situation were thwarted by those interested in maintaining the status quo. Clearly, if something concrete was to be achieved, the forces of the community would have to be mobilized. This necessity led to the establishment after 1845 of a number of voluntary health associations, patterned largely after organizations created in Great Britain. These groups undertook to educate the public to the advantages of public and private hygiene, to press for administrative reform, and to take action for the elimination of crowded, poorly ventilated, filthy tenements, impure water supplies, unwholesome food, and inadequate sewerage.

From the mid-forties onward there was constant agitation to tackle community health problems and to improve urban living conditions. As in Great Britain, the sanitary survey proved a most useful tool for the purpose. Such studies were carried out under the auspices of a committee of the American Medical Association formed in 1848. While the surveys were inadequate in many respects, they showed collectively the great need for better public health organization. This lesson was

further driven home by the cholera epidemic that broke out in 1849 and continued to harass different areas of the United States for some two years. Concurrently, events were moving along similar lines in Massachusetts to produce the most famous of the early public health documents of the United States, the Shattuck *Report*. Published in 1850 by the Massachusetts Sanitary Commission, the report was the work of Lemuel Shattuck (1793–1859) of Boston, a bookseller and publisher. While the *Report* had practically no effect when it first appeared, it is an important landmark in the evolution of community health action in the United States. It outlined a basis for sound public health organization and made recommendations that to a large extent have been realized in the intervening hundred years. The most important proposal was the establishment of a state health department, but Shattuck also considered subjects such as vital statistics, communicable disease control, care of the well child, health education, environmental sanitation, smoke control, and alcoholism. What Shattuck's plan would have been like in practice we do not know. His achievement, however, was to take ideas and practices of his predecessors and contemporaries, to adapt them to the American scene in a broad and coherent administrative pattern, and in essence to formulate a complete health policy.

However, the most effective study in terms of results was made in New York City. This was a detailed report by the Council of Hygiene and Public Health, formed in 1864 by the Citizens Association, a group organized to clean up the city government. The conditions that were uncovered by this group were even more shocking than had been suspected, and in the wake of the widespread interest that was aroused the State legislature enacted a bill setting up the Metropolitan Board of Health. This was in 1866, and marks a turning point in the history of public health not only in New York City, but in the United States as a whole. One of the basic problems with which the pioneer public health workers were concerned was the lack of adequate administrative machinery. The civil service during most of the nineteenth century was small in numbers, limited in function, and recruited almost wholly by patronage. A change from a haphazard to an efficient administration was as essential to the development of a complicated urban society as the provision of new scientific knowledge. In fact, it was the provision of a stable administrative foundation that made it easier to incorporate new scientific knowledge into public health practice. It was in New York City that such a foundation was created for the first time in the United States, and an example was set for others to follow. It led to the creation of new and effective health departments in various municipalities and states. The first state health department had been established by Louisiana in 1855, but it was not effective. In 1869 Massachusetts finally adopted the ideas of Lemuel Shattuck and organized a suitable state health department. Other states followed in rapid succession: California, 1870; District of Columbia, 1871; Minnesota, 1872; Virginia, 1872; Michigan, 1873; Maryland, 1874; Alabama, 1875; Wisconsin, 1876; and Illinois, 1877.

As state and municipal health departments began to appear, the idea of a national health organization seemed to be the logical next step. In 1879, Congress enacted a bill creating a National Board of Health, which existed until 1883. It was premature, and it was not until 1953 that a national health department came into being

in the United States. Nonetheless, by the last quarter of the nineteenth century, a sound basis had been created for the further development of public health in this country. Much still remained to be done, but the extensive cultivation of the community health program and the rewards that have been garnered in our century were made possible because basic organizational problems had already been solved. Within the American political framework, action on a national basis could not take place until it was realized that many problems of health and welfare could not be handled locally.

Meanwhile, the future content and direction of community health action was being determined abroad, in France and Germany. The great problem of public health was the prevention and control of communicable diseases. But there was lack of agreement on the nature and cause of these conditions. During the nineteenth century, however, knowledge was accumulating that pointed toward an animate contagion as the cause of infectious disease. Studies by Bretonneau on diphtheria (1826–1855), by Panum on measles (1847), by Snow on cholera (1849), and by Budd on typhoid fever (1859–1873) laid the foundation for modern scientific epidemiology and pointed to a living organism as the pathogenic agent in each case. The anthrax bacillus was seen by Davaine in 1850. Then, between 1856 and 1865, Pasteur established the germ theory of fermentation, the doctrine of biogenesis, and indicated the significance of this work for an understanding of communicable diseases. A period characterized by solid advances in technique and consequently in knowledge began in the seventies. Koch's incontrovertible demonstration, in 1876, of the microbial origin of anthrax and his elucidation of its natural history marked the beginning of the golden age of bacteriology. The advances that followed during the next two decades occurred with almost explosive rapidity, but in general they followed two distinct lines of development. One trend, characteristic of the work of Koch, led to the development of technical methods for the cultivation and study of bacteria. Pasteur and his co-workers took another direction, turning their attention to the mechanisms of infection and developing the consequences of this knowledge for the prevention and treatment of contagious diseases.

By the last decade of the nineteenth century some of the pertinent questions concerning contagious diseases had been answered by demonstrating specific causative organisms in numerous instances and showing how infection might be prevented. Nonetheless, certain observations remained unexplained and mysterious. Light was finally thrown on these obscurities in the germ theory of disease during the closing decade of the nineteenth century and the first decade of the twentieth century by a number of brilliant investigations, which revealed the part played by vectors, or intermediaries, in the transmission of communicable diseases.

While Americans contributed only in a limited degree to the growth of microbiological knowledge, they were more alert than their European confreres to its practical implications. Out of this awareness developed the diagnostic laboratory, a new public health institution for the application of bacteriology. It was in New York City that the new knowledge of bacteriology was first really applied in public health practice. Owing to the initiative of Hermann M. Biggs (1859–1923), who was to become one of the great leaders of American public health, a small diagnostic

laboratory was set up in the City Health Department in 1892. In this laboratory, directed by William H. Park, the discoveries of Pasteur, Koch, and others were systematically applied to the protection and improvement of the community's health. Establishment of public health laboratories by other local and state health departments followed rapidly after New York City had set up an example. Through these laboratories, health departments to a considerable extent took over the task of diagnosing communicable diseases and, in order to control these diseases, provided free biological products to physicians in practice and to public health officers.

The first decade of the twentieth century had a solid basis for the control of a number of infectious diseases, and throughout succeeding decades, up to the present, advances along this line have continued with increasing tempo. The meaning of this trend is clearly evident in the case of diphtheria. By 1900, diphtheria could be diagnosed by precise bacteriological methods, the sick person could be treated with diphtheria antitoxin, and well carriers could be detected, thus making possible really effective control. Eventually, direct prevention of the disease was achieved by active mass immunization, a method developed logically from earlier knowledge of the use of diphtheria antitoxin as a passive immunizing agent as well as a therapeutic agent.

As a result of community action along these lines arising from the sanitary reform movement and the bacteriological discoveries, the crude death rate had declined markedly by the first decade of the twentieth century. During this period, however, new developments occurred that vastly broadened the horizons of public health workers and turned their attention to new tasks. It was inevitable that the transformation of the United States from a rural, agricultural nation into one predominantly urban and industrial should have a profound effect on its civil institutions. The resulting expansion of governmental functions was already evident during the latter part of the nineteenth century, but the full impact of public undertaking in relation to health was not felt until well into the twentieth century. The decade between 1910 and 1920 marked the first great period in the formulation of American social policy and of legislation in relation to health.

An increasing concern with all phases of child life was a characteristic and prominent feature of this period and has continued to be up to the present. The establishment in 1908 of a Division of Child Hygiene in the New York City Health Department is a landmark in the history of the child health movement. This unit was the first of its kind in the world, and it set a pattern for other health departments in the United States and abroad. What New York City had done on a local level was carried forward by the states and the Federal government. Louisiana established a child hygiene unit in its state health department in 1912; other states followed in succeeding years. Federal recognition was given to child health when President Taft in 1912 signed a bill creating a Children's Bureau to investigate and report on all matters relating to child welfare. This agency was the result of the efforts of Florence Kelley and Lillian Wald, both members of that dedicated, militant band of men and women who at the end of the nineteenth century and during the first quarter of the present century undertook to curb some of the worst abuses of industrialization, thus preparing the way for the social and health legislation we have today.

During the same period, the protection of maternity also began to receive attention in the United States. Public awareness of the value of maternity care, coupled with advances in medical knowledge, has been responsible for the sharp declines in the mortality of mothers and infants and the general improvement in their health during the past 30 years. To a very considerable degree this is a result of action by the Federal government. An important step was the passage in 1921 of the Maternity and Infancy Act, popularly known as the Sheppard-Towner Act. This was the first measure to appropriate Federal funds for a health and social welfare purpose. A successful program based on Federal-state cooperation was carried on and provided a prototype for later activities in the thirties and forties.

Action in the interest of mothers and infants during this period is paralleled by the development of health services for school children. School medical inspection in the United States began sporadically in the 1870's. Not until the beginning of the present century, however, was an effective approach to this problem undertaken. This was initiated in New York City with the appointment of the first full-time school nurse in 1902. Several states, Vermont (1903) and Massachusetts (1906), passed laws relating to partial or complete physical examinations. Free clinics for school children were established in 1912 in New York City as a responsibility of the health department. The school lunch movement had its inception in New York in 1908 in an effort to supplement the diet of undernourished children. However, the most important single factor in developing the school lunch program was the depression of the thirties. There is no doubt that this program produced direct benefits in improving the health of children. Dental health services for children got off to a slow start in the United States. Only since the thirties has there been a broad development of active programs. The growth since then is indicated by the organization in 1938 of the American Association of Public Health Dentists. Since 1948, the fluoridation of community water supplies promises to reduce considerably the burden of dental care in the population of school age.

With the passage of time, many changes have taken place in the provision of health services for school children. There has been a shift of emphasis from the initial limited objectives of school health to a broader concept of this field. From a concern with the control of contagion had come the introduction of public health nursing services in schools. The program was then expanded by the introduction of periodic medical examinations and follow-up procedures for the correction of discovered physical defects. The goal for the years ahead is the total well-being of children, with particular attention to those who have special problems.

In dealing with the health problems of mothers and children, it is clear that a basic tool is education. The desired goals can be attained by spreading knowledge, by stimulating action, and, in the last analysis, by achieving changes in individual and group behavior. With the recognition and growth of this concept, organizations, techniques, and personnel were developed to reach the community as a whole, as well as particular groups and individuals in it. In working with individuals or with small groups, as in problems of maternal and child health, tuberculosis, venereal disease, or nutrition, it was essential to have a health worker who could work with and teach people in a manner adapted to their particular needs. A number of health

workers of this type have been developed in the past 50 years, among them the nutritionist and the dental hygienist. However, the first of these to appear and the most significant is the public health nurse, who today is a core member of the staff of any progressive public health agency. Furthermore, the emphasis on education led to a recognition that it had a major function in the community health program. The development of health education as it exists in the United States today was furthered to a very large extent by the voluntary health agencies that developed in the early decades of the twentieth century (National Tuberculosis Association, 1904; National Committee for Mental Hygiene, 1909; American Federation for Sex Hygiene, 1910; American Society for the Control of Cancer, 1913). In 1914, the New York City Health Department organized the first bureau for health education in an official agency. By 1929, 52 municipal and 36 state health departments were engaged in health education activities, and a few had full-time directors of health education. Slowly, a specialized worker, the health educator, was developed. The last 30 odd years have also seen the introduction of important technical means of communication, radio and television, as well as the continued spread of urban culture throughout the United States, due in large measure to improved means of transportation.

It is manifestly impossible to deal with all aspects of modern public health in the United States. The decade 1910 to 1920 saw the establishment of occupational health as a significant field of public health action. This is true as well of the problems of organizing and financing medical care.

Another important element has been the increasing professionalization of the field. Schools have been created during the past 40 odd years for the preparation of public health personnel on a professional level. An active role in the process of professionalization has been taken by the American Public Health Association. Originally organized in 1872, the association has generally had a most fruitful effect in shaping public health opinion in the United States.

The consequence of developments since the turn of the century has been an unprecedented over-all trend toward the improvement of community health. The diseases of infancy, youth, and early adulthood have been reduced to such an extent that more and more people live into the older years, and the community must concern itself with the health problems of a maturing population. In 1900, only 13,000,000 persons, or 18 per cent of the population of the United States, were in the age group older than 45 years. Fifty years later, this group comprised 43,000,000 persons, or 30 per cent of the population. Thus the problems that loom large today involve the control or prevention, if possible, of the less remediable chronic, noncommunicable diseases. At the same time the public health program has broadened to include, whenever feasible, other elements and situations that may adversely affect the physical and mental well-being of the community. The widening horizons of American public health have in recent years come to include such problems as accident prevention and mental health, as well as renewed emphasis on the control of the physical environment due to new factors introduced by our expanding and changing industrial technology. Recent years have also brought increasing attention to the social and economic changes accompanying our expanding industrialization and their consequences for the public health. Among these are the continuing

movement of population from the farm to the city and the countervailing flight from urban to suburban centers.

As steps are taken to tackle these new problems, it becomes increasingly clear that the organization and coordination of public health services will have to be considerably altered to be able to meet adequately the demands that will be made on them in the future. Public health in the United States may well be proud of its past and give Americans cause for gratification. We owe a deep debt of gratitude to the pioneers who created the foundations on which we now build. Today, the American community is in a better position than ever before in history to control its environment and to preserve health and avert disease. More and more we are able consciously to plan and to organize for better health because available knowledge and resources make it possible to act with a clear understanding of what we are doing. This does not mean that there are no more problems. Many health problems have been solved in terms of available knowledge, but this knowledge awaits application in practice. There are problems of community health that require political and social action guided by available knowledge. Only by resolutely facing and dealing with the new developments and challenges that are moving up to confront us can we keep American public health in the position of leadership that it today occupies in the world.

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American Medicine in the World Today: An Historical Perspective and Reappraisal

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The history of American medicine is a true mirror of the progress of civilization and culture in the Western hemisphere. The earliest American inhabitants of whom we have written record were the Indians, the very numerous tribes of North America and the much more advanced and gifted Mayas, Aztecs, and Incas of Mexico, Central America, and Peru.

While sand paintings, weird ritual dances, and the terrifying costumes of the North American Indian medicine man were long considered the chief healing measures of these Indians, later studies have brought a complete reappraisal. The North American Indians, nomadic and warlike, inured to the accidents of the hunt and the wounds of battle, developed much skill in the treatment of wounds and fractures. They also employed many drugs quite rationally—as cathartics, cascara podophyllin and jalop; as diuretics, wintergreen, sarsaparilla, and juniper; as a remedy for high fever and for "rheumatism," willow bark, the original source of salicylates. They were familiar with the effects of the peyote bean, the active principle of which, mescaline, has been the object of much recent pharmacological study.

If the materia medica of the North American Indian is surprising, that of the Aztecs is amazing. The Spanish conquerors of Mexico in their search for gold were quite unprepared for the wealth of drugs they found, for, as Moll remarked, "Rich as the Potosi mines proved, their value could not approach that contained in the depths of the New World forests." Francisco Hernandez described more than 3000 plants used by the Indians in the treatment of disease. Their materia medica included remedies of vegetable, mineral, and animal origin—poisons, antidotes, anthelmintics, aphrodisiacs, tonics, hemostatics, laxatives, oxytocics, antiseptics, and anesthetics. The knowledge of these drugs was rapidly disseminated throughout Europe, and at one time it was estimated that more than one half of the drugs in the pharmacopeias of Europe were of American origin—a statement that may still be valid.

The Spanish colonists, the first on the new continent, while spurred on by the hopes of rich booty, undertook other work more creditable and lasting. They established churches, libraries, hospitals, and colleges. A full century before the English settled Jamestown, the Spanish established a hospital at Santo Domingo; the Jesus Nazareno Hospital of Mexico City, which still continues its service to the sick, was founded by Cortes nearly a century before the Puritans landed at Plymouth. The English-speaking American, who is inclined to date American history from Jamestown or Plymouth Rock, is more than mildly surprised to learn that the Spanish established eight universities before Harvard was founded, that the University of Mexico was founded more than half a century before the English landed at James-

town, and that the first chair of medicine in the new world was created at the University of Mexico in 1580, 40 years before the landing of the *Mayflower*. The first medical book published in the New World was *Phisica Speculatio* by Alonso de la Vera Cruz, printed in Mexico in 1557, followed by Francisco Bravo's *Opera medicinalia*, printed in Mexico in 1570. Bravo's work is noteworthy for its account of *tabardillo*, one of the early classic accounts of typhus fever. The first medical publication in the new world in the English language was *A Brief Rule* by the Reverend Thomas Thacher, pastor of the Old South Church in Boston, who, though lacking medical training or a medical degree, devoted much time to the practice of medicine as part of his pastoral duties. This small broadside was published in Boston in 1677, more than a century after the appearance of the works of Alonso and Bravo.

The Spanish hegemony coincided with the Golden Age of Spain and the Golden Age of Spanish medicine, and Spanish medicine and the Spanish language were dominant in the new world.

With the advent of John Cabot, an Italian like Columbus, but sailing under the orders of the English king, and with the later colonization by the English, the Spanish no longer had a monopoly on the continent but were forced to share it with the English. The English, like the Spanish, brought their own language, religion, and culture to the colonies. In the end, the English prevailed in most of North America, and English became the dominant language. The Puritans, who settled New England, were particularly concerned with the spiritual state of the colony. They founded Harvard College at Cambridge in 1636, "dreading to leave an illiterate Ministry to the Churches when our present Ministers shall lie in the Dust." The Harvard Medical School was not established until more than a century later, and it was almost a century before the first hospital was opened in 1821. The Quakers who settled Pennsylvania had no clergy to educate and, stressing charity particularly as a basic tenet of their group, established the Pennsylvania Hospital in 1750 and the Philadelphia Medical School in 1765, the first medical school in English-speaking North America.

Colonial North America followed closely the medical pattern of London and Edinburgh. Like these two medical centers, it was also influenced by Leyden, Paris, and the Italian universities. John Morgan, one of the founders of the medical school in Philadelphia, after graduating at the College of Philadelphia received his medical degree at Edinburgh and then proceeded to Paris and to Padua, where he met Morgagni. Dr. Morgan's discourse, "The Institution of Medical Schools in America," delivered at the inauguration of the medical school in 1765, remains a classic in the history of American medical education. In this remarkable address, Dr. Morgan stressed the necessity of adequate premedical education and a graduated medical course and opposed the common practice of physicians' compounding their own medicines in favor of physicians' employing trained pharmacists to fill their prescriptions. "The pre-medical requirements, which had been the most progressive part of Morgan's plan, were thrown on the dump, whence they were salvaged with great *éclat* by the founders of Johns Hopkins University." (J. T. Flexner.)

The Puritans of New England in colonial times produced many divines of note but no physicians of great distinction, while Philadelphia produced physicians of dis-

tinction. One, Benjamin Rush, wrote the first American book on psychiatry and by his numerous writings gained a national and international reputation.

Although Dr. Morgan's suggestions were neglected and were not followed by the medical school or by its immediate successors, yet the urge to teach, one of the characteristics of physicians and philosophers throughout the ages, could not be suppressed. Medical schools began to appear. The Medical School of King's College was organized in 1768; one of its founders, Samuel Bard, a graduate of Edinburgh and a distinguished physician, has left us an early classic description of diphtheria. Harvard Medical School was founded in 1783 with a faculty of three—John Warren, the most prominent surgeon of New England; Benjamin Waterhouse, who had studied in London and Edinburgh and had taken his medical degree at Leyden, and who introduced vaccination into North America, an innovation that stirred up much animosity and resulted in his resignation from Harvard; and Aaron Dexter, professor of chemistry.

The founding of medical schools at first proceeded with apparent caution and hesitation, but with the years the pace quickened, and soon the movement became precipitate and headlong. "Medical colleges multiplied without restraint, now by fission, now by sheer spontaneous generation. . . . Wherever and whenever the roster of untitled practitioners rose above half a dozen, a medical school was likely at any moment to be precipitated." (A. Flexner.) The United States and Canada in the course of a century produced 457 medical schools; Illinois gave birth to 39 medical colleges; Missouri, to 42; New York, to 43. The city of Cincinnati produced 20 medical schools; Louisville, 18.

Poor as most of these schools were, and although some were even fraudulent diploma mills, yet there was sound medical instruction in many; and, although few, if any, really measured up to Dr. Morgan's standards, they were slowly progressing.

Some of these schools numbered outstanding men on their faculties and men of high achievement among their graduates. Valentine Mott (1785–1865), a graduate of Columbia College, New York City, and professor of surgery at the College of Physicians in New York, was a surgeon of international reputation, of whom Sir Astley Cooper remarked, "He has performed more of the great operations than any man living." Daniel Drake (1785–1852), who taught in a half dozen medical colleges, three of which he founded, who remarked often, "Medical Colleges have consumed me," was the author of *Diseases of the Interior Valley of North America*, a noteworthy book, which Garrison praised by remarking, "There was nothing like this book in literature unless it might be Hippocrates' *On Airs, Water and Places*." Austin Flint (1812–1886)—"the American Laënnec"—was a powerful figure in American medicine who established by his writings and demonstrations the value of physical examinations in the diagnosis of disease, while Samuel D. Gross (1805–1884), professor of surgery at Louisville and at Jefferson Medical College, wrote the first exhaustive treatise on pathological anatomy in the English language, a work that drew high praise from Virchow.

While most of the advances in American medicine during this period came from men connected with medical schools and working amid the creative ferment of students and colleagues, yet there were some notable exceptions.

In 1795, Ephraim McDowell, who had attended two sessions of medicine at Edinburgh but had left without a degree, returned to his home town of Danville, Kentucky, a town of about 1000 inhabitants, to practice medicine, a practice that took him on horseback hundreds of miles through the trackless wilderness. In 1809, he performed his epochal operation of ovariotomy on Mrs. Jane Crawford, who not only recovered promptly but lived 33 years after the operation. When his account of the operation was first published in the *Eclectic Repertory* in 1817, it was received with great skepticism. He continued operating and performed seven more successful ovariotomies. Eleven years after Dr. McDowell's ovariotomy in 1822, Alexis St. Martin, a French Canadian voyageur, was wounded at Fort Mackinac by the accidental discharge of a shot gun, which tore a large hole in his abdomen. He was treated by a young army surgeon, William Beaumont, who found a fistulous opening from the skin of the abdomen leading into the cavity of the stomach. Dr. Beaumont realized that this was an opportunity to study the digestive processes of the stomach in a manner never hitherto employed. After eight years of painstaking observations, hindered by numerous difficulties and frustrations, Dr. Beaumont published, in 1833, *Experiments and Observations on the Gastric Juice and the Physiology of Digestion*. This book took its place as one of the classics of physiology. The work by this army surgeon in the wilderness of North America, the "backwoods physiologist" as Dr. Osler called him, was quoted approvingly and with respect in the learned circles of London and Paris. Nineteen years later, in 1841, Crawford Long, a country doctor of Jefferson, Georgia, operated upon James Venable, removing a small tumor without pain after his patient had inhaled ether. Five years later, in the Massachusetts General Hospital of Boston, James C. Warren operated on a patient under ether anesthesia, administered by a dentist, W. T. G. Morton. Another of this small group who earned an international reputation and thus increased the stature of American medicine was J. Marion Sims, a native of South Carolina, who had established a private hospital in Montgomery, Alabama, and who in 1852 reported the operative cure of three cases of vesicovaginal fistula.

Until his report, there was not on record a single authentic cure of this distressing condition. The discoveries of Drs. McDowell and Beaumont made a deep impression on many learned circles in Europe. They were not quite prepared for medical discoveries in the backwoods and wilderness of North America. This initial advance was but a forerunner to the triumph of the discovery of surgical anesthesia, one of the great discoveries in medical history. Medicine in North America was coming of age.

Since the days of colonial medicine, North America had turned its eyes toward Europe for medical enlightenment and education. When North America was a British colony, the physicians who went abroad for their medical education went to London, where William and John Hunter, Sir Astley Cooper, and Lettsom were the celebrities, or to Edinburgh, where they sat under Cullen, Black, and Gregory. A few intrepid souls wandered out of the British orbit and sought instruction in Leyden.

The late eighteenth and early nineteenth centuries in France represent one of the most stirring epochs in history—the beheading of the king, the overthrow of the monarchy, the Reign of Terror, the French conquest of much of Europe, and the

downfall of Napoleon. A ferment similar to that which unleashed these tremendous social and political forces apparently spilled over into the fields of science, medicine, and surgery. It was the age of Lavoisier and Gay-Lussac in chemistry, of Laënnec, Bichat, Bayle, Pinel, Corvisart, Broussais, Dupuytren, and Larrey in medicine. Obviously the *civis Hippocratis*, in its wanderings down the centuries from Cos, had settled in Paris, and American students flocked to Paris to sit at the feet of these notables. Among the young Americans who migrated to Paris was Oliver Wendell Holmes, later to become famous as an American poet and literary man, but equally deserving of both fame and gratitude as one of the first physicians to point out the contagiousness of puerperal fever. Dr. Holmes, in his address "Some of My Early Teachers," has left us some unforgettable sketches of his teachers in Paris—Larrey, Dupuytren, Lisfranc, Bouillaud, Velpeau, and Louis.

Time always brings changes, and during the next half century, the *civis Hippocratis* moved from Paris to the Teutonic lands. American medical students now appeared in increasing numbers in Vienna, in Berlin, and in the smaller German universities. William Osler wrote in 1890, "The universities of Germany are her chief glory and the greatest boon she can give us in the New World is to return our young men infected with the spirit of earnestness and with the love of thoroughness which characterizes the work done in them." American students continued to flock to Germany for postgraduate instruction and to bring back to the new world new ideals and new points of view. The ferment, however, seemed slow in developing. Theodor Puschmann, the eminent medical historian of Vienna, in his *History of Medical Education*, published in 1891, noted that although, in America,

> . . . some medical schools enjoy, and justly so, a high reputation . . . along with these, however, there exist others which occupy a low position both intellectually and morally. . . . It is therefore not a matter for surprise that American degrees in medicine should be regarded with distrust in Europe and placed in the same category as those amiable but meaningless distinctions which are conferred on people dancing the cotillon.

Before this work appeared, William H. Welch had gone to Baltimore in 1884 to assume the chair of pathology at Johns Hopkins, and William Osler in 1888 had been appointed professor of medicine at this institution. Johns Hopkins University, which was formally opened in 1876, wrote a new chapter in the history of American higher education. The Johns Hopkins Medical School, formally opened in 1893, performed the same service in medical education. It placed the study of medicine on a graduate basis, requiring a college degree for admission, which prompted the remark of Dr. Osler that he was lucky to be admitted to the medical school as a professor since he could never have gained admission as a student.

Johns Hopkins had a definite influence in raising the standard of medical education, but it was largely a voluntary effort and limited. A much more powerful impetus was supplied by Abraham Flexner's *Medical Education in the United States and Canada*, a report that appeared in 1910. In the period of a few years, the number of medical schools had fallen to less than one half the original number.

The close of the nineteenth century and the early years of the twentieth saw American medicine steadily and rapidly progressing. Medical schools improved, and

American medical research assumed ever-increasing stature. In 1900, Walter Reed and his associates discovered the mode of transmission of yellow fever; in 1901, the Rockefeller Institute for Medical Research was founded, an institution whose members have made notable contributions to medical science. Here, in 1913, Noguchi demonstrated the *Spirochaeta pallida* in the brain of paretic patients and proved the syphilitic origin of general paresis; and in 1912, Alexis Carrel, a member of the staff, received the Nobel Prize in medicine, the first time this award had crossed the Atlantic.

American medicine has made notable strides during the past half century. When Alexis Carrel won the Nobel Prize for medicine in 1912, it literally created a sensation. Since that time no less than 12 scientists working in American institutions have been so honored. A generation ago, large numbers of American physicians went abroad for postgraduate work; foreign physicians who came to the United States for postgraduate instruction were few and far between. Today the reverse is true. Also, the opportunities for postgraduate work have vastly multiplied. Most medical colleges today give extensive postgraduate instruction, and many give circuit refresher courses that enable the active practitioner to carry on postgraduate study at home without leaving his practice. American physicians have always gone for study to those places that, in their judgment, provided the best opportunities—to Edinburgh, to London, to Leyden, to Paris, to Berlin. They have been chauvinistic and nationalistic only in the sense of being proud of the achievements of their fellows. They could, however, without arrogance or pride feel perhaps that the *civis Hippocratis* was now settling down on North America.

SYMPOSIUM ON MEDICINE AND WRITING

The Symposium on Medicine and Writing that appeared in the November 1956 issue of INTERNATIONAL RECORD OF MEDICINE has been published as a Monograph. The articles included in this Monograph are: "The Editing of a Modern Medical Textbook" by Russell L. Cecil; "Plain Talk and Clear Writing" by Morris Fishbein; "The Principles of Bibliographic Citation" by John F. Fulton; "The Art of Communication" by Joseph Garland; "On Writing a History of Medicine" by Douglas Guthrie; and "Minerva and Aesculapius: The Physician as Writer" by Félix Martí-Ibáñez

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Nutritional Factors in Atherosclerosis

A Review

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"Atherosclerosis in all probability has no single cause." This is the considered opinion of a group of experts[1] who made a study recently, on behalf of several organizations, of the relationship of atherosclerosis to the fat content of the diet. Heredity, diet, morphological and chemical anatomy of the blood vessel wall, arterial blood pressure, lipid content of the blood, sex, and other hormonal factors are among the influences seemingly involved. No doubt several of them are interrelated. Today attention is being directed increasingly to the nutritional aspects of the problem, particularly to the lipids of the diet and the lipids of the blood. This is natural because cholesterol plaques, occurring in the intima of the arteries, are a distinguishing feature of the lesion in atherosclerosis. The absorption, carriage, and metabolism of cholesterol, fat, and other lipids are closely associated with each other and all enter into the problem. Although there is not complete agreement on this point—and, indeed, in this field one finds complete agreement on very few points—most investigators hold that hypercholesteremia over a long period of time is, in some way, the ultimate or precipitating cause of atherosclerosis.

In this review we shall limit discussion to nutritional factors, although, as stated, there are a number of others that probably play a role. Some of these may also be modified by nutrition. Among the nutritional influences that have been studied the following may be mentioned:[2] calories (hypernutrition and hyponutrition), fat, cholesterol, entities other than triglycosides present in dietary fats, particularly the vegetable sterols and phospholipids, vitamin B_6, dietary protein, vitamins other than B_6 and minerals, particularly those related to hypertension.

For a while protein was regarded as a responsible factor, but it was soon found that any such relationship was probably due to the need for methione, in its role as a methyl donor. Atherosclerosis was produced in monkeys fed diets containing a protein prepared from soybeans and referred to as "alpha protein."[3] This protein has a low methionine content. Similar results have been obtained with rats, and it remains to be seen whether or not this phenomenon is related to proteins as a whole or simply to their methionine content. In either case, it would be quite significant. It has been stated that the incidence of deaths from degenerative heart disease fell remarkably during World War I and this was linked to a lowered intake of animal proteins. It does not seem to be related to a lack of methionine since animal food proteins in general are high in methionine. Consequently a lowering of methionine intake should result in a greater incidence of atherosclerosis rather than a lower one. However, both series of observations may be found to be related to some other amino acid imbalance. Furthermore, a low animal protein diet is almost invariably associated also with a lowered intake of animal fats.

With regard to vitamins, Rinehart and Greenberg[4] found that a diet deficient in pyridoxine produced "arteriosclerotic" lesions, although these do not appear to be typical of atherosclerosis. Nevertheless, Schroeder[5] believes that atherosclerosis is a "conditioned pyridoxal deficiency." He said that there is considerable evidence indicating that this vitamin is concerned with the formation and utilization of unsaturated fatty acids, and through this mechanism, pyridoxal deficiency can be the cause of atherosclerosis. This relation of pyridoxine and its derivatives to fat metabolism has been shown by several investigators.[6, 7] We shall discuss the unsaturated fatty acids and atherosclerosis in greater detail subsequently, but it is significant that the pyridoxine influence is considered to be brought about through its effect on fatty acids. No other vitamins have been shown to be implicated in atherosclerosis. Large doses of vitamin D produce vascular calcification, also not typical of atherosclerosis, in rats. This condition in rats can also be caused by a high-fat, low-choline diet, and supplementation of the high vitamin D intake with choline can prevent the deleterious effect of the hypervitaminosis.

Minerals have not been shown to have any definite or direct effect on the formation of atherosclerotic plaques. A high sodium content of the diet will intensify a tendency toward atherosclerosis, it is believed, and the common practice of restricting sodium in the diet of hypertensive patients may possibly be related to this, although there are other possibilities. Potassium may be shown to be of some importance since it is implicated in certain aspects of lipid metabolism, which appears to be a major factor in this connection.

Let us now consider the effect of hypernutrition. Mann and his group,[8] working in Stare's laboratory at Harvard, were able to produce hypercholesteremia, hyperbetalipoproteinemia, and atherosclerosis in monkeys by dietary means. The diet included 5 per cent of cholesterol and 30 per cent of the calories as fat. The protein was the aforementioned alpha protein, which is deficient in methionine. Therefore, one cannot attribute the disturbances in lipid metabolism to the relatively high fat content alone, since the alpha protein and high cholesterol are in themselves productive of hypercholesteremia. Hypernutrition is exemplified by obesity. Coronary atherosclerosis and other types of cardiovascular disease have, heretofore, been generally accepted as common in obese persons. This may be true for certain types of heart disease but has not been shown unequivocally to be the case in atherosclerosis. To be sure, Wilens[9] in a study of 1000 autopsies reported atherosclerosis to be twice as common in obese as in poorly nourished subjects. Persons of average nutrition came in between these two groups. Earlier, Rosenthal[10] had reported that the degree of atherosclerosis seen at autopsy was directly proportional to the obesity.

Faber and Lund's[11] results differed from those of these earlier investigations. They made analyses of aortas and found that obesity was not related to the dry weight or to the cholesterol or calcium content. There is not even clear-cut evidence that coronary heart disease occurs with greater frequency in obese than in underweight persons, nor does body weight appear to be related to the serum cholesterol level in healthy persons. The life insurance companies have sponsored numerous investigations on the relationship of overweight to heart disease. The earlier work indicated that obesity was associated with a shortened life expectancy and an in-

creased mortality from several diseases, notably cardiovascular disorders. Brozek and Keys[12] have recently reviewed the relationship of overweight, obesity, and coronary disease and questioned the validity of the conclusions obtained by life insurance statistics in this area. On the other hand, one must not conclude that there is no relationship whatever between lipid metabolism and heart conditions. The recent joint epidemiological reports[13] from Framingham, Massachusetts, Albany, New York, and Los Angeles showed that the incidence of new coronary disease was much greater in heavy persons than in those of normal build.

At this point it is necessary to consider cholesterol, because a high serum cholesterol is usually assumed to be associated with or a cause of atherosclerosis. The fact that the vascular lesions contain deposits of cholesterol is enough to warrant suspicion that this lipid is one of the causative factors. Feeding large amounts of cholesterol to rabbits and certain other experimental animals has long been known[14] to cause atherosclerosis. This is not true of all experimental animals, and it has usually been stated that it is not true of man. However, in a series of 60 persons, Groen et al[15] found high blood cholesterol figures when a high-cholesterol diet was fed and low blood cholesterol when the food had a low content of this lipid. It is thus probable that the blood cholesterol in man, to some degree at least, is dependent on the food cholesterol. However, cholesterol of serum is not necessarily derived from cholesterol of the diet. It can be synthesized from smaller molecules by the body.[16, 17] Acetic acid can be used for this purpose. Both carbons of this two carbon compound are utilized, and it is known exactly into which parts of the large cholesterol molecule each goes.[18]

The mechanism of the deposition of cholesterol is pictured by Page[19] as follows. The lipoprotein aggregates, which circulate in plasma, are known to be made up of cholesterol (whether obtained from food or biosynthesized as mentioned previously), phospholipid, amino acids, and fatty acids. These aggregates filter through the wall of the blood vessel and are deposited in the intima as "foreign" lipid. Some of the material in the aggregate is more soluble than the rest. Thus amino acids and some of the phospholipid are dissolved out and pass from the arterial wall into the tissue fluid or lymph. The cholesterol, fatty acids, and part of the phospholipid remain behind and become the atherosclerotic plaques. This results because the vessel fails to function properly as a filter or because the size, shape, and charge of the less soluble fractions of the lipoproteins are such as to permit them to stick. The cholesterol level of the blood fluctuates with the cholesterol of the diet.

A high-fat diet has been implicated in the causation of hypercholesteremia and, consequently, of atherosclerosis by many investigators. Keys is the leading proponent of this theory. His studies[20] and those of others were at first of a statistical nature. For example, he found that in Italy there is consumed in general a low-fat diet and there is a correspondingly low incidence of coronary disease. In those sections where the populace is able to afford a "richer" diet, the incidence of coronary disease is much higher. The figures for serum cholesterol tended to be low when the fat of the diet was low and increased with a more ample fat ration. A more striking but similar relationship was seen among Japanese nationals in Japan, Hawaii, and the United States. The "national" type of diet was of no consequence, but the propor-

tion of fat in it was apparently directly related to the level of cholesterol in the serum and to the occurrence of coronary disease. Similar examples were seen among the Bantus of South Africa with a low-fat diet and the Finns with a high-fat diet. In 1953 Keys[21] summed up much of this data in a graph showing the relationship between the national death rate for men aged 45 to 49 and 55 to 59 who had died of arteriosclerotic and degenerative heart disease and the proportion of fat calories generally present in their respective national dietaries. This was done for six different countries, and the graph showed an apparently definite relationship between these two variables. The conclusion was reached that "dietary fat somehow is associated with cardiac disease mortality at least in middle age."

These studies of Keys have been subjected to searching analysis by Yerushalmy and Hilleboe.[22] They showed that if the same sort of data for all countries for which they are available are assembled, the relationship is not nearly as evident. Furthermore, other factors, e. g., the amount of animal protein in the diet, could be substituted for the fat factor and a similar relationship to mortality from heart disease could be seen. In other words, the statistical approach, while interesting and suggestive, is not significant enough to prove a relationship between a high-fat diet and the causation of either atherosclerosis or heart disease.

Nevertheless, a strong case for such a relationship has been made by Keys and his group, as well as by other workers, by direct experimentation. In general, the intake of food fat is followed by a temporary hyperlipemia,[23] which reaches its maximum at five or six hours and returns to normal in 9 or 10 hours as the fat is utilized or stored. If cholesterol is included in the lipid intake, this will also rise in the blood, because cholesterol accompanies fat in absorption and, to some extent, in fat carriage. Mann and his co-workers have shown that *Cebus* monkeys develop hypercholesteremia, hyperbetalipoproteinemia, and atherosclerosis when fed a diet containing alpha protein, 5 per cent cholesterol, and approximately 30 per cent of the total calories as corn oil. As mentioned previously this is not clear-cut evidence for the effect of fat, since cholesterol and alpha protein were also included in the diet. In starvation, in which there is excessive fat catabolism, there is an elevated serum cholesterol. According to Peters[24] this results from a specific lack of carbohydrate for some operative function rather than a caloric deficit.

Of greater interest is the effect of a high-fat diet over a longer period of time. Recently Anderson, Keys, and Grande[25] made a very comprehensive investigation on men who were normal insofar as their nutritive state was concerned. They fed diets designed to show the effects of various fats covering a range of 9 to 41 per cent of the total calories. The low-fat diets consistently produced a fall in serum cholesterol concentration from the control or ordinary diet. High-butter fat diets produced a rise in serum cholesterol. Sometimes the rise in serum cholesterol after fat feeding is only fleeting, but usually it is definite. Using monkeys as the experimental animal, Portman and his co-workers[26] found that the serum cholesterol rose on feeding high-fat diets containing cholesterol. Wilkinson and his group in 1950[27] presented evidence that does not seem to agree with the thesis that a high-fat diet leads to a rise in serum cholesterol. They found that the absolute amount of carbohydrate, protein, fat, and cholesterol in the diet bore no relation to the total serum cholesterol,

nor was it possible to demonstrate any relation of total calories supplied by various dietary constituents to the total serum cholesterol. This is surprising since the subjects, 91 in number, were all members of one family, most of whom suffered from hypercholesteremia. It is possible, of course, that these persons had a quite abnormal type of lipid metabolism, perhaps deriving their serum cholesterol to a greater degree from biosynthesis than from food. Mann[28] also was unable to demonstrate a significant increase in serum cholesterol or serum beta lipoprotein levels in 2 normal men fed on high-fat (pemmican) diets.

The opposite phenomenon has, however, been demonstrated apparently conclusively. That is, a low-fat diet results, in general, in a low serum cholesterol level. The effect of the Kempner rice diet is a good example of this. This diet is low in fat as well as in protein and sodium. Patients on this diet were found[29, 30] to experience an average decrease of 40 mg./100 ml. in total serum cholesterol. Vegetarians have low cholesterol levels.[31] Here, however, the fat intake is not so drastically reduced, and this may be an example of the influence of the kind of fat rather than the amount. The feeding of a fat-free diet results in a very low blood cholesterol.[32]

It thus appears that inclusion of a large amount of fat in the diet may increase blood cholesterol, but the evidence is not unanimous. Recently a considerable amount of experimental work has shown that this lack of unanimity may be due to the fact that the kind of fat is just as important as the amount, if not more important. Furthermore, some fats actually depress cholesterol levels. Kinsell and his group[33] have shown this to be the case when chemically constant diets, containing large amounts of vegetable fat, were fed. Not only was there no increase in plasma cholesterol levels, and the levels of other plasma lipids, but there was a definite decrease. Replacement of the vegetable fat by animal fat resulted in a prompt return of the lipids to levels noted on an average diet. This has been confirmed by Ahrens et al,[34] who found significant reductions in serum concentrations of free and esterified cholesterol and of phospholipids when plant fats were substituted isocalorically for animal fats. The vegetable fats used included peanut butter and corn oil. This study was on human beings and was continued for four months. The fall in these lipids approximated 20 per cent. There was no change in neutral fat levels of the blood. A similar result was reported by Beveridge and his group.[35] They fed to human beings diets containing a high content of corn oil, with or without supplementary cholesterol. These led to a decrease in plasma lipid levels, including that of cholesterol.

Kinsell and Michaels[36] have shown that calorically constant diets, containing large amounts of vegetable fats, not only caused no rise in plasma cholesterol and other plasma lipids but actually lowered the plasma lipid level. Substitution of an animal fat for the vegetable resulted in a prompt return to levels found in taking an average diet. The fall in serum lipids, according to Kinsell, is related directly to the degree of unsaturation of the fat, rather than to its origin from vegetable or animal sources. Hydrogenated coconut oil, a vegetable fat, produces no lowering of serum lipids, or very little. In Portman's experiments on *Cebus* monkeys, a change from a diet containing corn oil to one containing hydrogenated cotton seed oil led to a rise in serum cholesterol. Diets containing lard with cholesterol also produced

strikingly greater serum lipid rises than did diets based on corn oil and cholesterol. Anderson, Keys, and Grande[25] have pursued this matter still further. Their subjects were mental patients, otherwise physically and metabolically "normal." The diets used were adequate in calories and all the nutrient factors. The fats used (with their iodine numbers) were olive oil (85), cottonseed oil (108), hydrogenated coconut oil (3), corn oil (120), sunflower seed oil (130), and sardine oil (188).

The low-fat diets consistently produced a lowering of the serum cholesterol level when compared with the controls on an ordinary fat diet. When added to the low-fat diets in 50 Gm. amounts, olive oil and cottonseed oil were equally effective in producing a similar but less marked lowering of the cholesterol. But when fed in 100 Gm. amounts, cottonseed oil had a greater effect than did olive oil, and sunflower seed oil and sardine oil were also quite effective. Corn oil was the most effective in lowering the blood cholesterol, while coconut oil was quite ineffective. These investigators summarized these effects in relation to the unsaturation of the fatty acids fed as follows:

> The serum cholesterol responses to the various fats corresponded roughly to the principle that saturated fats promote higher cholesterol levels than polyunsaturated fats but neither degree of saturation (iodine value) nor content of linoleic acid fully explained the results. Coconut oil is less cholesterol-promoting than would be predicted from the theories that degree of saturation or the content of essential fatty acids is the controlling factor. Sardine oil is considerably less cholesterol-depressing than would be expected if degree of unsaturation is the major factor. And corn oil caused greater depression of serum cholesterol than would be expected from either the essential fatty acid or the degree of unsaturation theories.

This peculiar property of corn oil to lower cholesterol levels had already been observed by others but the comparison had not been as strikingly brought out. Thus Beveridge and his co-workers[35] had used homogenized formula diets and had found that corn oil with or without supplementary cholesterol led to decreases in the plasma levels of cholesterol and other lipids while butter fat increased these levels, although only temporarily. Ahrens and his group,[34] using special hospital diets, found that 6 obese subjects showed significant reductions in serum concentrations of free and esterified cholesterol and of phospholipids when plant fats were substituted isocalorically for animal fats during a four month metabolic ward study. The approximate magnitude of the change was a 20 per cent decrease. The plant fat supplements were a mixture of several plant fats, including corn oil.

Tobian and Tuna[37] have recently described some striking clinical trials in which the total fat intake varied widely. The subjects were patients with coronary atherosclerosis having a wide range of serum cholesterol levels. No restrictions to the diet were made other than the addition of corn oil or the substitution of corn oil for other fats. This was given in the amount of 1 to 1½ ounces before each meal. It was usually emulsified in some aqueous flavoring extract. The use of corn oil as a salad oil and as a cooking oil was also encouraged. Sixteen of the 23 patients had at least a 15 per cent decrease in the serum cholesterol, i. e., from an average of 271 mg./100 ml. to 208 mg. Others had smaller decreases. None showed an increase and the decreases were maintained for an entire year during which corn oil was ingested. Usually the drop in serum cholesterol occurred after about a week of

corn oil ingestion, but in some cases the fall was very gradual over a period of about a month. Since these patients did not gain weight, they must have automatically curtailed the intake of other foods.

Some investigators believe that the effect of vegetable oils on the cholesterol level is due entirely to their content of unsaturated fatty acids. The essential fatty acids, particularly linoleic, are stressed in this connection. Fish oils and seal oil seem to possess this property although not to as great an extent as the vegetable oils. When any of these oils are hydrogenated, they lose this property. Recently, Kinsell and his associates[38] have fed purified esters of linoleic acid to healthy persons and to atherosclerotic patients and have found that these unsaturated fatty acid esters lower the plasma lipid levels. This drop is most marked for neutral fats but is evident also in the fall in blood cholesterol. Nevertheless, there must be some other factor operating because, as stated previously, the degree of effect is not entirely a function of the iodine number. Anderson stated: "We have shown that change from a corn oil diet to sun flower seed oil, which is still more unsaturated and richer in linoleic acid, produces a *rise* in serum cholesterol in man and a still greater rise results from changing from corn oil to sardine oil with an iodine number of 188."[28] Thus, while the unsaturated oils have a considerable effect in lowering the cholesterol level in the blood, corn oil seems to have the maximum effect, which is not entirely due to its unsaturation. It is, perhaps, significant that serum of atherosclerotic patients contains a lower percentage of the unsaturated fatty acids, linoleic and arachidonic, than the serum from random blood donors.[39]

The suggestion has been put forth that there may be some other substance present that operates in the same direction, if not synergistically. The sitosterols are often mentioned. These are plant sterols. They are not absorbed from the intestinal tract as cholesterol is. Experiments designed to test this hypothesis have been performed in several laboratories. In 1951 Peterson[40] found a striking reduction in the plasma cholesterol of chicks when soy sterols were added to the cottonseed oil of the diet of chicks. Later his group[41] conducted long-term experiments of a similar nature, corroborating the earlier results and noting a significant decrease in the incidence of atherosclerosis in these animals. Using rats, Hernandez and his co-workers[42] fed labeled cholesterol and determined the amount recovered from the lymph. When plant sterols and beta sitosterol were fed with the cholesterol, less cholesterol was recovered than when cottonseed oil was substituted for the plant sterols. Rosenmann et al's work[43] in rats did not corroborate this, and Wilkinson et al[44] reported a similar negative result in human beings. In this last work, it must be mentioned that the dietary fat used was of vegetable origin, which would tend to keep the cholesterol low. Several studies on the effect of plant sterols on blood lipids in man have been reported. Best and his co-workers[45, 46] gave 5 or 6 Gm. of beta sitosterol to 16 patients for periods up to one year. Most of them were hypercholesterolemic and experienced significant reductions in serum cholesterol. Other blood lipids fell, including the so-called "atherogenic" lipoproteins. Joyner and Kuo[47] reported similar effects. Another long-term experiment on human beings has recently been reported by Lesesne, Castor, and Hoobler.[48] Seven patients were treated for an average of 6.4 months with either soy sterols or beta sitosterol. At the beginning, all had

high cholesterol values and all experienced a significant reduction in serum cholesterol values. The sterols were taken in 3 Gm. doses before each meal.

It is possible, therefore, that corn oil may have special virtues as a cholesterol-reducing agent by reason of its content of beta sitosterol (about 1 per cent) as well as its possession of unsaturated fats. The mechanism of the action may be different in the two cases. It is suggested by Pollack,[49] on the basis of experimental evidence on rabbits and on men, that plant sterols may form nonabsorbable complexes with cholesterol within the lumen of the gastrointestinal tract, thus inhibiting the absorption of this lipid. Just how the unsaturated fatty acids produce their effect has not been postulated but it is probably some effect on cholesterol metabolism.

The question naturally arises: how should these results be put to practical use? Should normal persons as well as those having atherosclerosis, or who are threatened with it, change their diet? If the weight of the individual and blood pressure are "normal," there is certainly no need for a change. Kinsell,[35] however, is of the opinion that "it would seem desirable to include a relatively high intake of unsaturated fat in the average dietary." Perhaps a greater proportion of vegetable fats might tend to lessen the possibility of hypercholesteremia, but this is quite conjectural. Obese persons should consume fewer fat calories and these should be partly vegetable fats. Persons with high blood pressure or having a hypercholesteremic trait or background might do well to substitute part of their fat intake with vegetable oils, particularly corn oil. It should be remembered, however, that the addition of this or any other fat to an otherwise satisfactory diet is not to be recommended, since obesity and possibly hypercholesteremia is likely to result eventually.

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Alcohol Studies Monographs

The launching of a new monograph series, the *Monographs of the Yale Center of Alcohol Studies*, has been announced by the Center's Publications Division. The series will be published in collaboration with the Free Press of Glencoe, Illinois, and will report results or original research in any of the scientific disciplines carried out at Yale and elsewhere.

SIMPLE DIAGNOSTIC TEST FOR PSORIASIS. A simple diagnostic test for psoriasis that can spot characteristic chemical abnormalities in skin scales was recently described by Peter Flesch (University of Pennsylvania School of Medicine, Philadelphia). His research has disclosed that psoriatic scales have a high pentose content while glucose is more predominant in other scaly conditions. When defatted psoriatic scales are soaked overnight in water, the aqueous extract turns the brick red or purple color of pentose when heated with the reagent. Extracts of scales from other conditions produce an olive green to light brown color typical of glucose-pentose mixtures.

TETRACYCLINE COMBINATION CLEARS GYNECOLOGICAL INFECTIONS. Treatment of acute and chronic infections in 50 gynecological patients with tetracycline-glucosamine (Cosa-Tetracyn, Pfizer) effected clinical improvement in 44 and cure in 31 (AM&CT 5:322, 1958). Of the three groups treated, cases of incomplete abortion (22) exhibited the best response. Tolerance of the drug was uniformly good. The incidence and severity of side effects are comparable to those expected with similar dosages of tetracycline alone.

NOISE CONDITIONS MAY AFFECT HEARING. The possibility that the hearing of a "significant portion" of the American population is being adversely affected through wider use of noise-producing automobiles, trains, planes, subways, power mowers, electric shavers, vacuum cleaners, and outboard motors was suggested by Charles D. Yaffe (Public Health Service, Cincinnati), on the basis of a controlled study in the workshops of Federal penitentiaries. Preliminary findings indicate that under certain noise conditions, most of the apparent hearing loss occurs in the first three months of employment.

PRODUCTION OF VALVULAR LESIONS. Valvular lesions have been produced in rats exposed to such stressful situations as cold, dampness, high altitude, and arteriovenous shunts, reported Alfred Angrist (New York City) and co-workers. These lesions were found to be microscopically represented by edema, increased cellularity, and platelet thrombi. Since adrenal hyperplasia is also seen in these stressful situations, simultaneous adrenalectomy was performed in some of the experiments, but it was found that the endocarditis still occurred, and perhaps to a greater extent.

PLASTIC REPAIR FOR EXSTROPHY OF BLADDER. Satisfactory plastic repair in 2 cases of exstrophy of the bladder was reported by Jacob J. Longacre (Cincinnati, Ohio) and co-workers. Fascia lata from the left thigh was used to reinforce the anterior abdominal wall over the bladder, covering it with skin flaps. One patient was 2 years old, the other, 12. Both operations are being followed up by training to obtain voluntary bladder control. Reconstructive surgery was substituted for ureterosigmoid anastomosis, described as frequently resulting in infection, back pressure, and changes in blood chemistry.

CHLOROQUINE BENEFITS ARTHRITIS PATIENTS. Five years' continuous treatment of rheumatoid arthritis with chloroquine (Aralen, Winthrop) have confirmed earlier observations of the antimalarial drug's high level of effectiveness and safety, it was reported at the recent meeting of the A.M.A. in San Francisco. One hundred of 150 patients treated with the drug (250 mg. daily) received major improvement or are in remission after one or more years of therapy. These patients now have complete functional capacity and the ability to carry on all usual duties without handicap or can do heavier work despite some discomfort. No serious toxicity was noted in any of the 150 patients.

SAFER CHILDBIRTH REPORTED. Mortality from complications of pregnancy and childbirth dropped almost 50 per cent between 1950 and 1956 in some of the 28 countries and territories covered in a recent WHO report (Epidemiological and Vital Statistics Report 2:no. 3, 1958). Denmark had the lowest rate for 1956 (48.2/100,000 live births) and Ceylon had the highest (376.5). In Israel (Jewish population) the rate was 48.4; Scotland, 53.5; France, 55.3; Australia, 56.1; England and Wales, 57; Northern Ireland, 57.6; Canada, 61.7. For the U. S. the latest rate given is for 1955 (47/100,000); the 1955 rate for Hawaii is 50/100,000.

COLOR PHOTOS OF INSIDE OF STOMACH. An electronic flash that is attached to the exploratory end of a gastroscope, directly beneath the opening through which the stomach is viewed, has made it possible to take colored pictures and slides of the inside of the human stomach safely. The device was invented by Prof. Ch. Debray and Pierre Housset (Faculty of Medicine of Paris). A prism reflects the image through a series of lenses encased in the tube. A 35 mm. camera is attached to the viewing end of the gastroscope. The physician can view the diseased area of the stomach, focus the image with the camera, and snap the shutter button that is synchronized with the flash.

Bright Twilight*

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In contrast to the years that were devoted to the worship of youth after World War I, the Western world now reveres maturity. Historically, gerontocracy has certain advantages. History has recorded times for the young and times for the aged. The former have nearly always been periods of crisis; the latter, of stability. For centuries Greece glorified her youth only to succumb politically at the hands of Alcibiades, a young man of dictatorial ambitions. Rome, on the other hand, sought the support of the mature, and that Rome of *patres* and senators became mistress of the world.

This country is now bound toward an age governed by silver-haired men. Medicine's contribution to these men must not be solely "adding years to life and life to years"; it must also teach them that gray hairs are a reward, not a penalty. But gray hairs must be deserved.

When young, no one stops to think that one day he too will be old; old age then is only a reflection in the mirror of somebody else's old age. As André Maurois said, we rebel at the biological injustice that allows a carp to live three hundred years while Byron and Mozart died at thirty. To those two attributes of old age, acceptance and serenity, must be added gymnastics not only of the mind and body, but also of the heart, for the secret of prolonging youth lies in knowing how to preserve Hope so that its bright light may shine upon the twilight of life.

Age has not always been looked upon as the last station but one in life's journey to the land of shadows. In the Renaissance, "old men," because of their experience, were sought after in the arts and in war, as occurred in the *Tercios* in Flanders. This concept of the experienced old man was replaced in the eighteenth century by that of the "autumnal," a literary concept, of some biological value, which yielded in our own time to that of "involution," or the process of man's physical and mental adaptation to those new circumstances that arise during that turbulent crisis known as the climacteric, when man is no longer capable of strenuous physical effort and, sometimes, of procreation. But these losses are compensated by a stronger and more efficient dynamism derived from the consolidation of his ideas, and from a superior mental activity in politics, science, and art. Even in love the older man has learned that it is possible to replace successfully youth's greater frequency of passion by skill and imagination, as proved in his old age by the immortal rascal Casanova.

There is an enchanting book called *The Art of Long Life* by Luigi Cornaro, a sixteenth century Venetian nobleman. Cornaro loved life with ever-increasing intensity to the end of his days. Until the age of forty he was an overindulgent hedonist; but thereafter he made sobriety his rule for long, happy life and reached the ripe old age

*This editorial was originally published in *MD* Medical Newsmagazine, August, 1958.

of ninety-five, having written in his last few years four books on the art of long living, wherein he described his famous diet of *panado* (a clear broth with a coddled egg), veal, and wine, which he called "the old man's milk." This dynamic old man said that there was no reason why *after* ninety one should abandon the idea of a paradise on earth, a noble ambition revived in modern geriatrics.

Medical advice, however, is not all that is needed in old age. It must be supplemented by a simple philosophy founded on a conscious and willing renunciation of the superfluous and an increased sense of responsibility and curiosity regarding the marvel of Life. Therein lies the secret of how to continue creative work and preserve Hope in senescence, two things that can render life's autumn into a bright springtime.

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